

PALEONTOLOGY AND DISTRIBUTION
OF THE
BEAVERTAIL LIMESTONE
OF THE
MACKENZIE RIVER VALLEY

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J.CMAWDSLEY

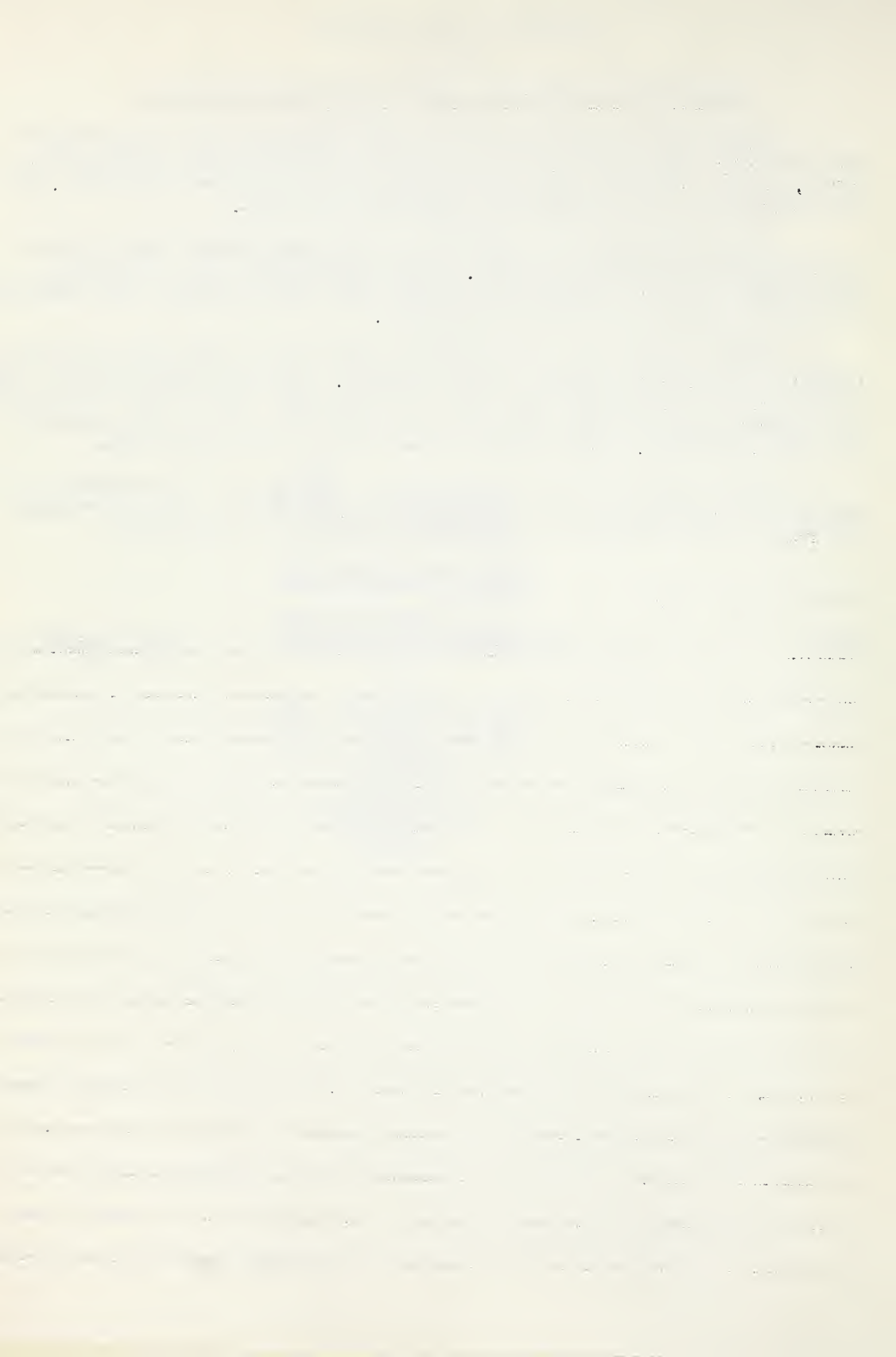
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The undersigned hereby certify that they have read and recommend to the School of Graduate Studies for acceptance, a thesis entitled "Paleontology of the Beavertail Limestone of the Mackenzie River Valley" submitted by James Cleugh Mawdsley, B.Sc., in partial fulfilment of the requirements for the degree of Master of Science.

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ABSTRACT

This thesis contains descriptions of a number of new species and varieties of **B**rachiopoda which were collected from the Middle Devonian of the Mackenzie River Valley. All but one of the described fossils were labelled as having been collected either from the Beavertail limestone of uppermost Middle Devonian age or from the "marl above the Beavertail." From a study of the faunal assemblages it is believed that the "Beavertail" and "marl above the Beavertail" fossils which are described belong in the Ambocoelia meristoides zone of the Middle Devonian and that the horizon from which the fossils were collected is correlative with an horizon in the Pine Point limestone.

In none of the "Beavertail" fossil collections which were studied was the Beavertail type section fauna recognized. This indicates that no true Beavertail limestone is present at the various localities from which the fossils were collected.

THE UNIVERSITY OF ALBERTA

PALEONTOLOGY AND DISTRIBUTION OF THE
BEAVERTAIL LIMESTONE OF THE MACKENZIE
RIVER VALLEY

A DISSERTATION

SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF SCIENCE

FACULTY OF ARTS AND SCIENCE
DEPARTMENT OF GEOLOGY

by

JAMES CLEUGH MAWDSLEY

EDMONTON, ALBERTA,

APRIL, 1954.

PREFACE

The Devonian formations of the Mackenzie River Valley were first named by Kindle and Bosworth (~~Kindle, E. M. and Bosworth, T. O.,~~ (1920) as outlined below. Since that time a considerable amount of geological investigation has been carried out in the area, especially during the last war when efforts were made to find some extension to the known oil bearing strata. The Canol Investigation was the most important of these efforts and many field parties were active in the vicinity of Norman Wells reporting on the stratigraphy and structure of the region. At the conclusion of the investigation Dr. G. S. Hume and Dr. T. A. Link (1945) attempted to assemble and correlate the information obtained by the field parties. For the most part this was successfully accomplished. In respect to the Middle Devonian section however, they found it impossible to use the formational names as erected by Kindle and Bosworth and had to resort to the use of one formational name for all of the Middle Devonian.

Hume and Link mention the unconformable relations existing between the Upper Devonian Fort Creek shale and the Middle Devonian formations in the northern part of the area. The nature of this unconformity was made the subject of a

study by Drs. P. S. Warren and C. R. Stelck of the Department of Geology, University of Alberta (~~Warren, P. S. and Stelck, C. R.,~~ (1949) who demonstrated that the Fort Creek shales of Upper Devonian age overlay successively older Middle Devonian formations in a northerly direction from the type section at the Ramparts of the Mackenzie River. In the Anderson River area and below Fort Good Hope the Fort Creek shale lies directly on the eroded surface of the Hare Indian River formation, the earliest Middle Devonian formation.

In the Paleontological Museum of the University of Alberta are many fossil collections made by geologists of the Canol Project and earlier expeditions which are labelled Beavertail limestone, the latest Middle Devonian formation. In making these collections, conformable relations with the underlying Ramparts formation were assumed. Some of these collections undoubtedly came from horizons other than Beavertail correlatives. The problem of the Beavertail was recognized by Hume and Link and dealt with in their Canol Report by subordinating both the Beavertail and the Hare Indian River shale under the expanded formation "Ramparts." Later, Warren and Stelck (1950) introduced faunal zones in the Devonian of Western Canada. In this study Beavertail limestone fauna in the Lower Mackenzie River Valley was described only from the type section at Carcajou Rock. Collections of fossils

labelled "Beavertail limestone" from other localities were not included.

The object of this study is to identify the fossils of the "Beavertail limestone" collections in the Paleontological Museum of the University of Alberta and to place them in their proper horizon.

ACKNOWLEDGMENTS

The writer wishes to express his appreciation to all members of the Department of Geology for guidance and encouragement during his graduate and undergraduate years.

The writer wishes especially to express his appreciation for the assistance rendered him by Dr. P. S. Warren under whose guidance this thesis was written and for the guidance and assistance rendered him by Dr. C. R. Stelck in the course of this study.

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CHAPTER 1

INTRODUCTION

I. History of Exploration

The Mackenzie River was first explored by Alexander Mackenzie in 1789 when he descended the river now bearing his name to its mouth and returned to Fort Chipewyan, his starting point, on the north shore of Lake Athabaska. This journey was accomplished in one hundred and two days and has been described as "one of the most remarkable feats in the history of inland discovery whether regarded in the light of results achieved or of the time taken to cover a journey of nearly three thousand miles."* (*from Geol. Surv., Canada, memoir 108*)

Previous to Mackenzie, in 1771 and 1772, Samuel Hearne of the Hudson's Bay Company explored the Coppermine River to its mouth and crossed Great Slave Lake. In 1778 Peter Pond also of the Hudson's Bay Company explored Lake Athabaska. Pond was the first white man to see this large body of water.

The first geological observations in the Mackenzie River Valley were made by Sir John Richardson while serving as a member of Captain (later Sir) John Franklin's expeditions of the years 1825 - 6 - 7. This

expedition descended the Mackenzie from Great Bear Lake to the head of the delta where the party divided into two groups which explored the coast east and west of the mouth of the Mackenzie River before returning to Great Bear Lake. In 1848 Sir John Richardson again descended the Mackenzie and continued his geological observations. In the same year R. W. McFarlane of the Hudson's Bay Company explored in the Anderson River region. About this time^{on} A. K. Isbister spent some time in the Mackenzie River Valley and adjoining country making geological notes. In 1855 Isbister published a map and report in Volume XI of the Quarterly Journal of the Geological Society of London which summarized all that was known up to that time of the geology of the Mackenzie River Valley.

From 1890 to 1917 a number of explorers travelled in the Mackenzie River Valley and some of them published their findings in various publications. A bibliography of this literature is contained in Memoir 108 - Geological Survey of Canada.

After 1920, when oil was discovered at Norman Wells on the Mackenzie River, exploration activities were accelerated and various geological investigations were carried out particularly by the Geological Survey of Canada. In 1942 the Canol Project was initiated due to the military necessity of developing a source of oil in northern Canada.

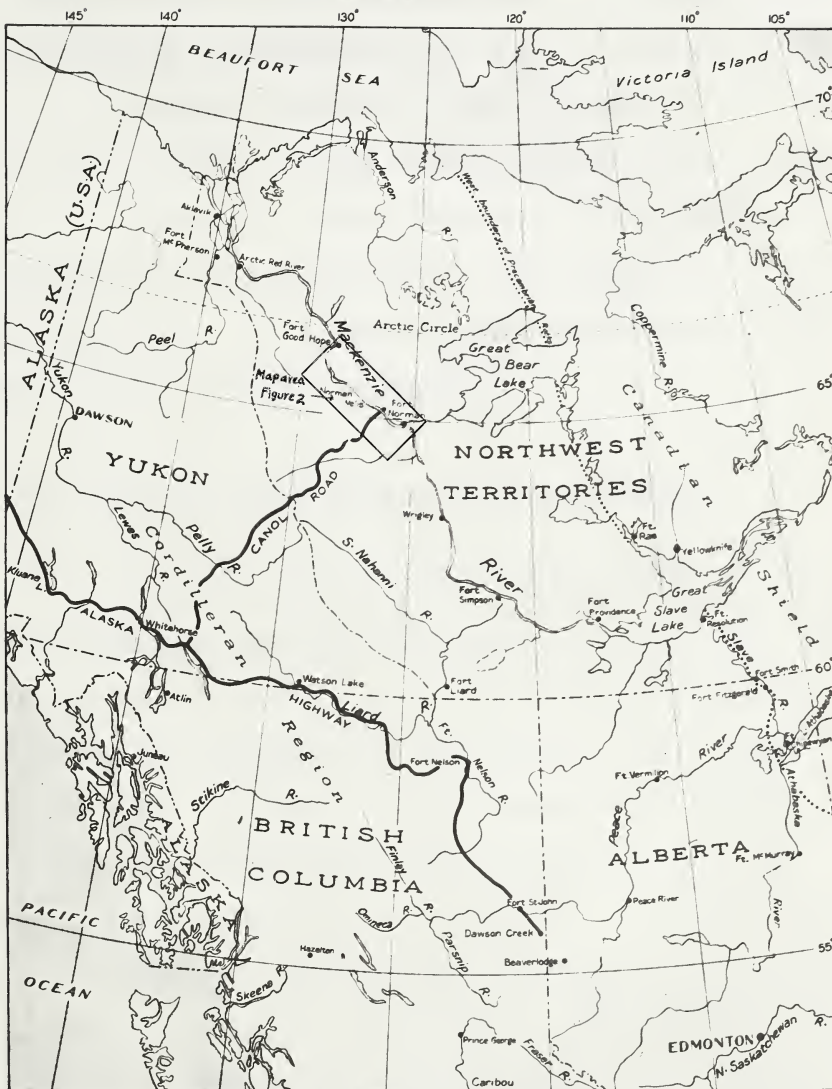


Figure 1 Index map of western part of NORTHWEST TERRITORIES, showing MACKENZIE RIVER BASIN.

The project was carried out by the Canadian and United States Governments and Imperial Oil, Limited. Geological investigations were under the supervision of Dr. T. A. Link. This project added considerably to the geological and geographical knowledge of the area. A summary of the geological knowledge acquired by this project is contained in Geological Survey, Canada, Paper 45-16 *by Hume and Link (1945)*.

Today the Lower Mackenzie River Valley is a relatively well explored part of the North West Territories. Various geological investigations are carried out during the summer months by private concerns.

II. Previous Discussions of Paleontology

A description of the fossil faunas of the Mackenzie River Valley was first made by F. B. Meek (1868) when he described material collected in the Mackenzie River Valley by explorers for the Hudson's Bay Company (McFarlane and Ross) and the Smithsonian Institution (Kennicott). A later description of fossils from the Mackenzie River Valley was published by J. F. Whiteaves (1891) who examined material collected by R. G. McConnell of the Geological Survey of Canada in 1887-88-89-90 during his extensive explorations in the area. A. E. Cameron (1917) first named the Devonian formations in the vicinity

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of Great Slave Lake, dividing the section into Upper and Middle Devonian. Kindle and Bosworth (1920) named the Devonian formations in the Lower Mackenzie River Valley and correlated them with the section at Great Slave Lake. In these last two reports no fossil descriptions were included. After 1920 The Geological Survey of Canada carried out various investigations and reports were published by A. E. Cameron, G. S. Hume, E. J. Whittaker and M. Y. Williams in the years from 1920 to 1923*. In these reports lists of fossils were included but there were no descriptions of species and the value of these lists was limited by indefinite identifications and the lack of knowledge regarding the range of some species.

P. S. Warren (1944) of the University of Alberta made a study of Devonian Brachiopoda of the Mackenzie River in collections at the University of Alberta. This report was the first discussion of Mackenzie River geology which included fossil descriptions since Whiteaves' report of 1891.† P. S. Warren and C. R. Stelck (1949 and 1950) were co-authors of two reports which included lists of fossils from Devonian formations of the Mackenzie River Valley. The second of these two reports introduced 20 fossil zones for the Devonian of Western Canada (Figure 3).

In recent years considerable work has been done in the Mackenzie River Valley by private concerns

* see Bibliography

† note also: Smith, S., Upper Devonian Corals of the Mackenzie River Region, Canada: Geol. Soc. Amer., Spec. Paper 59, 1945.

but their information has not been published and was not available to the writer.

III. Devonian Stratigraphy

Following is the table of Devonian formations of the Lower Mackenzie River Valley and their correlation with those of the Great Slave Lake area as originally proposed by Kindle and Bosworth (1920):

	Formations	Thickness in feet	Correlation with the Hay River Section
Upper Devonian	<u>Bosworth</u> sandstone and shale	2,000 plus	<u>Hay River</u> limestone and shale
	<u>Fort Creek</u> shale	500 - 1,000	Hay River shale (including the Simpson shale)
Middle Devonian	<u>Beavertail</u> limestone	350	<u>Slave Point</u> limestone
	<u>Ramparts</u> limestone	250	<u>Presquile</u> dolomite
	<u>Hare Indian River</u> shales	300 plus	<u>Pine Point</u> limestone

Hare Indian River shale: This formation was described by Kindle and Bosworth (ibid.) from the Ramparts of the Mackenzie as a bluish grey calcareous shale in strata 1 inch to 3 inches thick. The base of the section was not observed. Good exposures of the shale were observed at other localities also, particularly at the mouth of the Hare Indian River and in the cliffs below Good Hope.

Ramparts limestone: This limestone was described from the Ramparts on the Mackenzie by Kindle and Bosworth (ibid.) where it is believed to be overlain disconformably by Cretaceous strata. Kindle and Bosworth did not recognize the Beavertail formation in this locality. The surface of the top of the Ramparts was described as highly irregular indicating erosion. Beds of Upper Devonian age are not present at the Ramparts. The Ramparts limestone is characterized by the presence of the brachiopod Stringocephalus burtini.

Beavertail limestone: The Beavertail was described by Kindle and Bosworth (ibid.) from Beavertail Point on the Mackenzie River as a hard bituminous limestone with some shaly partings. In this locality Kindle and Bosworth described the contact with the Upper Devonian Fort Creek shale as gradational.

The character of this limestone bed and its relation to the overlying formation was described from the exposures at the northern end of Carcajou Mountain as follows (ibid.):

Carcajou Mountain Section

- a. Shale, fissile, black, with interbedded bituminous limestone becoming more calcareous in upper 16 feet and splitting into sheets of bluish-black, bituminous limestone 65 feet plus
- b. Limestone, grey 5 feet
- c. Shale, fissile, black 1 foot
- d. Limestone, dark, magnesian, of saccharoidal texture and bituminous odour 4 feet
- e. Limestone, hard, dark blue, with one or two thin bands of black slate in the lower half 55 feet

The contact with the Ramparts limestone was not described.

Fort Creek shale: The Fort Creek shale was originally described by Kindle and Bosworth (ibid.) from Thunder River and was noted in many other outcrop areas in the Mackenzie River Valley. The formation was found to be made up of bituminous shales with thin seams of dark limestone and calcareous sandstone; shales black or dark, but

in places burnt brick red; marine shells common. No limestone beds or reef limestones were noted in the formation as originally defined.

Drilling in the vicinity of Norman Wells has revealed the presence of a reef limestone in the Fort Creek shales. In the Canol Report Hume and Link (1945) give the following section for the Fort Creek in the Norman Wells area:

<u>Description</u>	<u>Thickness</u> (feet)
Upper Fort Creek shales	700 - 800
Bituminous zone	100 - 400
Reef limestones	0 - 400
Lower Fort Creek shales	385 - 540

The reef limestone here referred to is locally known as the Kee Scarp reef. In some areas adjoining the Norman Wells area the reef may not be present. In one location on Carcajou Ridge the reef limestone was described by Hume and Link (1945) as lying on the Middle Devonian with no intervening shales.

In their Canol Report, Hume and Link (1945) found it impracticable to use the subdivisions proposed by Kindle and Bosworth for the Middle Devonian and proposed the following classification:

Upper Ramparts limestone member

Middle Ramparts shale member

Lower Ramparts limestone member

The Upper Ramparts limestone member includes the Ramparts and Beavertail limestones of Kindle and Bosworth. These were placed in one member because it was found that a division between them is not practicable. The Middle Ramparts shale member includes the Hare Indian River shale of Kindle and Bosworth and some older beds that do not outcrop on the Mackenzie River. The Lower Ramparts limestone member was described by Parker from Mountain River on the flank of the Imperial Range. This latter was proposed by Hume and Link as the type area for the Lower and Middle members of the expanded Ramparts formation. In this area the section of Middle Devonian is much thicker than at Norman Wells. The Mountain River section as described in Hume and Link (1945) consists of the following succession:

<u>Description</u>	<u>Thickness</u> (feet)
<u>Upper Ramparts limestone member:</u>	
Limestone, grey, buff weathering, massive, many small <u>Cladopora</u>	80
Limestone, dark grey beds 0.6 foot thick and separated by black shale partings;	

limestone weathers grey and contains many small <u>Cladopora</u>	17
Limestone, dark grey, massive	10
Shale, black, earthy and limy, contains many Stromatoporoids and <u>Cladopora</u>	9
Limestone, black, massive, petroliferous	6
Limy shale, black to grey-brown, petroliferous; contains many large <u>Cladopora</u>	58
Total thickness	180

Middle Ramparts shale member:

Grey to green shales and limy shales with many thin limestone beds. In the lower 100 feet these thin limestone beds are commonly coquinoid. Fossils present are: <u>Reticularia</u> , <u>Productella</u> , <u>Proetus</u> , <u>Zaphrentis</u> , <u>Cladopora</u> , <u>Atrypa</u> (<u>spinosa</u>), <u>Cystiphyllum</u> , <u>Euomphalus</u> , <u>Palaeocyclus</u> , <u>Favosites</u> , <u>Syringopora</u> , <u>Shuchertella</u> , <u>Heliophyllum</u> , <u>Acervularia</u> , <u>Prismatophyllum</u> , <u>Pachyphyllum</u>	700
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Lower Ramparts limestone member:

Limestone, dark grey to black, petroliferous beds 1 to 5 feet thick and with irregular black shale partings; <u>Martinia</u> , <u>Atrypa</u> , <u>Productella</u>	100
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Limestone and shale; thin platy, dark grey to black limestone beds up to 6 inches thick with shale layer 3 inches thick; very fossiliferous; corals	135
Limestone, dark grey to black, massive at top and bottom and rubbly in central 2.5 feet. Very fossiliferous (<u>Acervularia</u> , <u>Cladopora</u> , <u>Paracyclas</u> , <u>Pugnoides</u>)	6
Limestone, dark grey, rubbly to platy and shaly; <u>Cystiphyllum</u>	129
Limestone, black, hard, brittle, very petroli- ferous, in beds $\frac{1}{2}$ foot to 8 feet thick with black shale partings	<u>75</u>
Total thickness	445
Total thickness of Ramparts formation	1,325

In the Norman Wells area the Lower and Middle Ramparts formations could not be differentiated into map-
pable units and it was decided by Hume and Link that where
this condition existed the entire Middle Devonian section
would be included in the term Ramparts formation.

The type section for the Upper Ramparts
limestone member of Hume and Link is at the Ramparts of
the Mackenzie. It is here defined as the limestone beds
of Middle Devonian age below the Cretaceous and above the
Middle Ramparts shale member the beds of which were originally
named Hare Indian River shale by Kindle and Bosworth (ibid.).

The section of the Upper Ramparts at the Ramparts on the Mackenzie was divided into two members and described by Parker. The following is Parker's section as described in the Canol Report of Hume and Link (1945):

<u>Description</u>	<u>Thickness</u> (feet)
<u>Beavertail formation</u>	
Limestone, light to dark grey, medium grained, fairly regular beds with bitumen partings. All of the beds contain some corals and Stromatoporoids , and some of the upper beds are composed of coral fragments in a bituminous matrix. <u>Megalodon</u> sp. is very abundant in some of these beds and also in the unit below this one. Rubbly biohermal beds alternate with more regularly bedded limestones that weather and break to sharp angular edges	65
Limestone, light grey, medium grained, contains coral fragments that are usually larger than the fragments in the above unit. The limestone is coarser grained than in the above beds, and contains little bitumen except at the partings. The coral fragment content of one bed may vary from 10 to 90 percent	

within a few hundred feet. The beds themselves are lensing and range from a vanishing point to 25 feet in thickness. Included in this unit are two or three lensing groups of dark grey, bituminous beds 10 plus feet thick 130

Ramparts formation

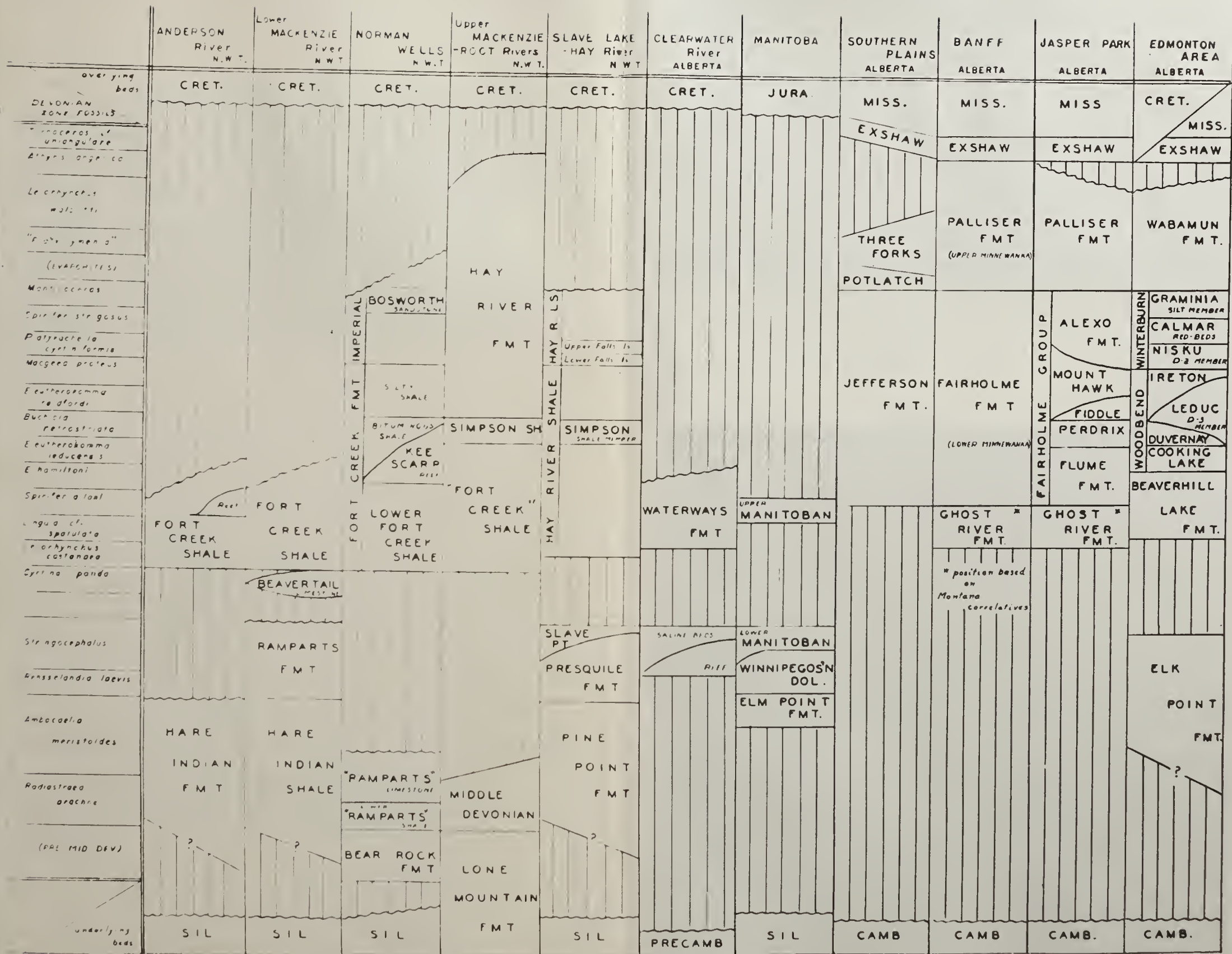
Limestone, dark grey, course grained, petroli-ferous. This is a Stromatoporoid limestone that contains many corals. The corals are generally much larger than those found in the Beavertail limestones. These beds contain dark grey, limy shales in irregular bands and around the individual Stromato-poroid nodules. There are regular shale partings 18 to 24 feet above the base of this unit 32

Shale, black, earthy. The upper contact of this bed is an irregular biohermal zone.

The shale contains abundant very large

Cladopora and Cystiphyllum corals 2.5

Total thickness 229.5



The ^{lower} shale bed was noted by Kindle and Bosworth and it serves as a marker bed in this area. Below this shale bed about 120 feet of limestones were described in which the fossil Stringocephalus burtini was noted and Stromatoporoids were abundant. These limestones are included in the Upper Ramparts limestone member of the Middle Devonian. This makes the Ramparts section of the Upper Ramparts limestone about 350 feet thick.

IV. The Problem of the Beavertail

Kindle and Bosworth (1920) recognized the Beavertail as a distinct formation and mapped it as such on the map accompanying their report. The Beavertail was recognized in several localities on the Mackenzie River from Bear Mountain to Beavertail Mountain, a distance of 120 miles and on various creeks flowing into the Mackenzie from the east between these two localities. It was also mapped as forming the crest of Kee Scarp. The thickness was given as 300 to 400 feet and it was referred to as a resistant bed forming ridges marking the trends of the main anticlinal folds between Norman Wells and the Ramparts.

In later geological work carried on in the Lower Mackenzie River Valley, difficulties arose in studies made of the upper most Middle Devonian. This was due to several factors which had not been realized by Kindle and Bosworth when they named the formations of the Middle Devonian in this area. The first of these is that an unconformity is present between the Upper and Middle Devonian as outlined by Warren and Stelck (1949). This unconformity bevels the surface of the Middle Devonian in such a way that the Upper Devonian overlies progressively older beds in a northerly direction from the Ramparts of the Mackenzie. The unconformity is also well expressed in the Norman Wells area. A second factor is that there is often a reef limestone developed near the base of the Fort Creek shales of Upper Devonian age which overlie the Beaver-tail and in some places this reef limestone has been confused with the Beavertail formation. A lower shale member of the Fort Creek is usually developed and separates the reef limestone from the Beavertail limestone but it has been shown that in some places the reef limestone lies directly on the Beavertail with no intervening shale member. Another source of difficulty is that it has been found that there is no sharp lithologic break between the Beavertail and the underlying beds. These and other problems were dealt with

by Hume and Link (1945) by placing all the Middle Devonian in the "Ramparts" formation.

The first indication of a problem of the Beavertail was mentioned by Kindle and Bosworth (1920) when describing the Carcajou Ridge section. In the description of this section the following statement was made: "About 1 mile up the river from the section, where the limestones stand vertical, about 260 feet of limestone is exposed. Stringocephalus burtini occurs abundantly in the innermost or lowermost 60 feet of these rocks indicating the identity of a part or the whole of the limestones on the river bank at this point with the Ramparts series which forms the base of the Beavertail limestone." This indicates the inability of Kindle and Bosworth to define the base of the Beavertail limestone on a lithologic basis. It also indicates the possibility of post Stringocephalus beds being present at this locality (Carcajou Ridge) in the Middle Devonian. A division of the Beavertail limestone from the Ramparts limestone on the basis of the fossil Stringocephalus burtini however is limited in application in that it is possible that this fossil will fail to appear at its proper horizon.

Another indication of the problem of the Beavertail appeared in 1922 when Hume (1922) reported Stringocephalus burtini from a horizon 60 feet below the Fort Creek - Beavertail contact at Carcajou Mountain. This limited the Beavertail to a maximum of 60 feet in this

section. In this 60 foot section, which was unusually fossiliferous for the Beavertail formation, Hume (ibid.) found the following fauna:

Martinia cf. meristoides

Cyrtina sp.

Atrypa reticularis

Reticularia sp. (a large form, abundant)

Chonetes sp. (very small)

Leiorhynchus sp. (a large form)

Productella sp.

Stringocephalus burtini (60 feet below contact with
the Fort Creek)

Bryozoans were abundant in some beds.

Hume (ibid.) described the Fort Creek - Beavertail contact along the southern end of Wolverine anticline (Carcajou Mountain) as sharp whereas at the north end of the structure the contact was described as gradational. Where seen in other areas Hume described the contact as sharp.

From Hume's work of 1922 it is evident that the Beavertail (Middle Devonian post Stringocephalus beds) possibly exists at Carcajou Mountain but is separable from underlying beds only on the basis of paleontology and it is in the order of 60 feet in thickness in this area. In the Canol report by Hume and Link (1945) it was stated that Parker limited the Beavertail to 10 feet on Carcajou Mountain.

It was stated in the Canol report that Parker was of the opinion that Kindle and Bosworth included the Ramparts limestone, the Beavertail limestone, the Lower Fort Creek shales and the reef limestone of the Fort Creek formation in their description of the Beavertail limestone. Another indication that the Beavertail limestone was not clearly defined by Kindle and Bosworth is that Parker (ibid.) considered about 200 feet of the upper beds of the Middle Devonian exposures at the Ramparts of the Mackenzie as true Beavertail limestone. In their original work at this locality Kindle and Bosworth (1920) did not recognize the Beavertail limestone as being present. They considered all the limestone beds above the Hare Indian River shales to the base of the Cretaceous as Ramparts limestone. It was in fact proposed as the type section of the Ramparts limestone.

It is evident that recognition of the Beavertail limestone is made difficult because of the lack of a distinct lithologic break with the underlying beds. Due to the fact that the beds are not always fossiliferous, separation of the formation on paleontologic evidence is not universally applicable. In general it can be said that the Beavertail formation is made up of those limestone beds lying below shales bearing Leiorhynchus castanea and above limestones bearing Stringocephalus burtini. Where

these two are not present and other fossil evidence is lacking, separation of the Beavertail formation cannot be definite.

A summary of sections of Middle Devonian rocks studied by geologists of the Canol Project and included in the Canol Report by Hume and Link is outlined below.

Ramparts of the Mackenzie: (Parker)

Beavertail formation: bituminous limestone,	
coral fragments	200 ft.
Ramparts limestone: many Stromatoporoids	
and <u>Stringocephalus burtini</u>	<u>120 ft.</u>
Total thickness of section	320 ft.

Carcajou Ridge: (Parker)

Upper "Ramparts" limestone	60 ft.
Middle "Ramparts" shale	745 ft.
Lower "Ramparts" limestone	<u>96 ft.</u>
Total thickness of section	901 ft.

Mountain River - (30 miles above the mouth): (Parker)

Upper "Ramparts" limestone: many <u>Cladopora</u>	
and Stromatoporoids	180 ft.
(includes Beavertail - 80 ft.)	
Middle "Ramparts" shales: many thin	
limestone beds	700 ft.
Lower "Ramparts" limestone: fossiliferous ...	<u>445 ft.</u>
Total thickness of section	1,325 ft.

Schooner Creek: (Stelck)

Middle Devonian "Ramparts" formation 341.5 ft.

Canyon Creek: (McKinnon)

"Ramparts" formation 380 ft.

Bear Rock: (Stelck)

Middle Devonian 350 ft.

Carcajou River - below mouth of Imperial River: (Bath)

Middle Devonian limestone 255 ft.

Imperial River Area: (Laudon)

"Ramparts" formation 450 ft.

Upper Carcajou - Imperial River: (Nauss)

Upper "Ramparts" limestone 100 ft.

Middle "Ramparts" shale 310 ft.

Lower "Ramparts" limestone 90 ft.

Total thickness of section 500 ft.

Donnelly River area - Bath Hills: (Foley)

"Ramparts" formation (composite section) ...1,391 ft.

Beavertail (included) -- 220 ft.

Beavertail Point: (Parker)

Beavertail limestone 35 ft.

(coralline bituminous limestone)

Carcajou - Little Bear River Divide area: (Stelck)

Upper "Ramparts" limestone 139 ft.

Middle "Ramparts" shale 255 ft.

Lower "Ramparts" - not mentioned

Total thickness of section 394 ft.

Thicknesses of Middle Devonian sections appear to be quite variable. Thirty miles above the mouth of Mountain River 1,325 feet of "Ramparts" formation was measured by Parker. In contrast, on Schooner Creek, 60 miles distant from the above section, the "Ramparts" formation as measured by Stelck is 341 feet in thickness. On Carcajou River, below the mouth of Imperial River, Bath measured 255 feet of Middle Devonian beds. This section lies about 24 miles west of the Mountain River section. It is doubtful however if this latter section is complete. There is a section of Middle Devonian strata 901 feet in thickness on Carcajou Ridge as measured by Parker. North of Carcajou Ridge, in the Bath Hills, Foley reported 1,391 feet of "Ramparts" formation. Two-hundred and twenty feet of these beds were recognized as Beavertail limestone.

At the Ramparts of the Mackenzie the section of the Middle Devonian is thinner, being about 320 feet as measured by Parker. South west of Carcajou Ridge, on Canyon Creek, near Norman Wells, McKinnon recognized 380 feet of beds in the "Ramparts" formation. At Bear Rock Stelck placed 350 feet of strata in the "Ramparts" formation.

Provided that these thicknesses are correct it is possible that post Middle Devonian - pre Upper Devonian erosion removed some of the Middle Devonian beds

where the Middle Devonian section is relatively thin. Where this erosion was least active the upper most Middle Devonian beds would have been preserved. One locality where this condition is possibly present is in the area of the series of anticlines making up Beavertail Mountain, Bath Hills, East Mountain, West Mountain and Carcajou Ridge. This is of significance in that the type section of the Beavertail limestone and the collecting locality for zone fossils of the Beavertail limestone is on Carcajou Ridge. Middle Devonian sections are much thinner to the south west at Norman Wells and Bear Mountain. To the west of the Mackenzie River, Middle Devonian sections range in thickness from 1,325 feet to 400 feet on Mountain River and in the Carcajou-Little Bear River Divide area respectively. It is possibly of significance that the thicker of these sections is only about 20 miles from Carcajou Mountain.

CHAPTER 2

PALEONTOLOGY OF THE BEAVERTAIL LIMESTONE

I. Type Section - Carcajou Rock

The following list of fossils was drawn up by Warren and Stelck (1950) from a study of specimens which had been collected from the Beavertail limestone (uppermost Middle Devonian) type section on Carcajou Rock, District of Mackenzie, N.W.T.:

Coenites sp.

Leiorhynchus cf. castanea (Meek)

Pugnoides solon T. & S.

Pugnoides sandersoni Warren

Pugnax sp. nov.

Tylothyris cf. inutilis (Hall)

Spirifer euryteines Owen

Spirifer sp. nov.

Cyrtina panda Meek

Athyris vittata var. buffaloensis Stainbrook

Atrypa sp. nov.

Martinia cf. occidentalis Merriam

These forms make up the Cyrtina panda zone of uppermost Middle Devonian age as introduced by Warren

and Stelck (1950). It was stated that this zone is closely associated with the overlying zone through Leiorhynchus castanea Meek and has little in common with the underlying Stringocephalus zone.

This fauna appears to be related to Devonian faunas of Missouri, Nevada and Iowa. Spirifer euryteines Owen has been collected and described from Upper Devonian beds of Missouri by Branson (1923). Martinia occidentalis Merriam is a Middle Devonian form of Nevada. The fossil Athyris vittata var. buffaloensis Stainbrook was named from an uppermost Middle Devonian horizon of Iowa by Stainbrook (1942).

This distinctive fauna does not appear to be widespread in the Lower Mackenzie River Valley. This is shown by the fact that very few elements of the Cyrtina panda zone fauna appear in the collection which was examined in the course of this study. The fossils studied were allegedly collected from the Beavertail limestone of the Mackenzie River Valley.

II. Bosworth Creek

Of the various collecting localities under discussion, Bosworth Creek is the source of the largest suite of fossils. This collecting locality is approximately

four miles north of Norman Wells. The Bosworth Creek fossil suite contains several previously undescribed species of brachiopods and is made up of the following fossils:

Proetus sp.

Coenites sp.

Zaphrentis sp.

Streptelasma sp.

Prismatophyllum sp.

Alveolites sp.

Heliophyllum sp.

Cystiphyllum sp.

Productella sp.

Atrypa cf. clarkei Warren

Atrypa cf. arctica Warren

Atrypa cf. reticularis (Linnaeus)

Leptaena sp.

Martinia sublineata Meek

Martinia franklinii Meek

Stropheodonta 43311 sp. nov.

Stropheodonta 43234 sp. nov.

Stropheodonta 43225 sp. nov.

Schizophoria striatula (Schlotheim) var. 43247 var. nov.

Schizophoria 43248 sp. nov.

Ambocoelia meristoides Meek

Hypothyridina 43214 sp. nov.

Gypidula 43298 sp. nov.

Atrypa borealis var. lata Warren

Atrypa 43234 sp. nov.

Atrypa arctica Warren var. 43232 var. nov.

Atrypa borealis Warren var. 43151 var. nov.

It should be noted that in this list of fossils Coenites sp. is the only form present which is also found at the type section of the Beavertail limestone. This suggests that true Beavertail limestone is not present on Bosworth Creek and that some other horizon was considered as Beavertail when the collection was made. Coenites is known from horizons other than the Cyrtina panda zone and cannot be considered as diagnostic by itself.

Certain forms are present in the Bosworth Creek "Beavertail" collection which are known in the Mackenzie River Valley from other Middle Devonian horizons. Ambocoelia meristoides Meek which is present in the Bosworth Creek "Beavertail" collection is the zone fossil of the Ambocoelia meristoides zone. This fossil is collected from the Hare Indian River shale of the Lower Mackenzie River Valley and from the Pine Point limestone of the Great Slave Lake area. Other elements of the Ambocoelia meristoides zone present in the Bosworth Creek collection

are Martinia franklinii Meek, Martinia sublineata Meek and Atrypa arctica Warren which have been collected from the Hare Indian River shale and from the Pine Point limestone.

Some elements of the Stringocephalus burtini zone are present in the Bosworth Creek collection though Stringocephalus burtini Defrance is not present. Elements of this zone collected on Bosworth Creek from the "Beavertail" limestone are Coenites sp., Ambocoelia meristoides Meek and Proetus sp. from the Ramparts limestone.

The absence of Stringocephalus burtini Defrance does not preclude the possibility that beds of the Stringocephalus zone are mistaken for Beavertail limestone as this fossil is not always present throughout the zone.

The Stringocephalus zone of the Devonian in Manitoba bears some fossils which are similar to elements of the Bosworth Creek "Beavertail" collection. These are Cyathophyllum cf. lonense Stumm, Alveolites vallorum Meek, Martinia sublineata Meek, Atrypa cf. arctica Warren, Proetus mundulus Whiteaves, Cladopora sp., Atrypa cf. independensis Webster and Martinia cf. meristoides Meek.

However, the Bosworth Creek "Beavertail" horizon appears to be more closely correlative with a

Pine Point horizon and should be placed in the Ambo-coelia meristoides zone of the Middle Devonian.

III. Morrow Mountain

A fossil assemblage was collected from the "marl above the Beavertail" of Morrow Mountain. The "marl above the Beavertail" directly overlies the "Beavertail" as recognized by the Canol geologists. The fossil assemblage is as follows:

Coenites sp.

Streptelasma sp.

Favosites sp.

Schizophoria striatula (Schlotheim) var. 43247 var. nov.

Cyrtina 43618 sp. nov.

Martinia sublineata Meek

Stropheodonta 43629 sp. nov.

Atrypa 43625 sp. nov.

Atrypa borealis var. lata Warren

Atrypa borealis Warren

Cyrtina 43618 sp. nov. is similar to Cyrtina panda Meek but the one specimen of the former form which was available was not enough evidence to draw any firm conclusions on the relationship of the two forms.

Schizophoria striatula var. 43247 var. nov.
is present in the "Beavertail" limestone collection of
Bosworth Creek. The specimens of this species from the
two localities are identical in appearance.

Another distinctive fossil in this collection
is Atrypa 43625 sp. nov.. An identical fossil from the
Houston River - Arctic Red River area is present in the
Canol collection. The latter specimen was collected
from the Ramparts limestone. It is possible that the
same horizon is represented in each area by the occurrence
of this species.

The fossil content indicates that the "marl
above the Beavertail" belongs in the same zone as the
Beavertail of Bosworth Creek.

On the basis of the presence of Atrypa
borealis var. lata Warren, Atrypa borealis Warren and
Martinia sublineata Meek this fossil collection can be
placed tentatively as coming from an horizon in the
Ambocoelia meristoides zone of the Middle Devonian.

IV. West Mountain

The collection from the "Beavertail" lime-
stone of West Mountain is as follows:

Coenites sp.

Cyathophyllum sp.

Martinia franklinii Meek

Delthyris 43635 sp. nov.

Schizophoria 43674 sp. nov.

Atrypa cf. reticularis (Linnaeus)

Pentamerella 43678 sp. nov.

Atrypa cf. spinosa

This list contains none of the Beavertail limestone type section fossils (Cyrtina panda zone). Martinia franklinii Meek has been reported from the upper part of the Hare Indian River shale. It was described from the Beavertail limestone by Warren (1945) but is reportedly widely distributed in the Lower Mackenzie River Valley unlike the Beavertail type section fauna.

V. Imperial River

The following forms were collected from "Beavertail" limestone on Imperial River:

Coenites sp.

Zaphrentis sp.

Atrypa 43151 sp. nov.

Atrypa arctica Warren

Martinia franklinii Meek

Atrypa cf. reticularis (Linnaeus)

This collecting horizon can be tentatively correlated with the "Beavertail" of West Mountain on the basis of Martinia franklinii Meek which is present in both collections and on the basis of Atrypa cf. reticularis (Linnaeus), identical forms of which are present in both collections.

An element of the Bosworth Creek "Beavertail" collection in the form of Atrypa borealis Warren var. 43151 var. nov. is present in the Imperial River collection.

This fauna bears no resemblance to the Beavertail type section fauna. It is more characteristic of a zone lower in the Middle Devonian.

VI. Other Areas

In this study a new variety of Ambocoelia meristoides Meek is described from the "Beavertail" of Oscar Creek near Norman Wells (Ambocoelia meristoides Meek var. 43106 var. nov.). This locality is only 9 miles from the Bosworth Creek collecting locality and it is possible that the "Beavertail" limestone at these

two localities is correlative.

From the Upper Mackenzie River Valley at Walker Creek a new variety of Atrypa arctica was described (Atrypa arctica Warren var. 41085 var. nov.) from the "Beavertail" limestone. Atrypa arctica Warren is known from several horizons in the lower part of the Middle Devonian, especially the Ambocoelia meristoides zone.

From the Ramparts of the Mackenzie River the following forms were recognized:

Megalomus sp.

Schizophoria sp.

Atrypa borealis Warren var. 42236 var. nov.

No Beavertail type section forms were noted.

CHAPTER 3

FOSSIL DESCRIPTIONS

This chapter contains the descriptions of 14 species and 6 varieties of Brachiopoda which have not been previously described from the Devonian of the Lower Mackenzie River Valley and are believed by the writer to be new. All described fossils are figured in the plates. The hypotypes are in the University of Alberta Paleontological Collection and are referred to in this study by the index numbers on the specimens. The fossil index numbers are explained in the Canol fossil accession index which was prepared by Stelck, Huff and Sluzar for Imperial Oil, Limited. The Canol fossil accession index is unpublished but is available in the Department of Geology, University of Alberta.

All but one of the described fossils were labelled as having been collected ^{either} from the Beavertail limestone of Middle Devonian age or the "marl above the Beaver tail".

Classification Table

Phylum Brachiopoda

Class Articulata

Order Palaeotremata

Impunctate Articulata

Superfamily Pentameracea

Genus GYPIDULA Hall 1867

Gypidula 43298 sp. nov.

Genus PENTAMERELLA Hall 1867

Pentamerella 43678 sp. nov.

Superfamily Rhynchonellacea

Genus HYPOTHYRIDINA Buckman 1906

Hypothyridina 43214 sp. nov.

Superfamily Spiriferacea

Genus ATRYPA Dalman 1828

Atrypa arctica Warren var. 43232 var. nov.

Atrypa arctica Warren var. 41085 var. nov.

Atrypa borealis Warren var. 42236 var. nov.

Atrypa borealis Warren var. 43151 var. nov.

Atrypa 43234 sp. nov.

Atrypa 43625 sp. nov.

Genus DELTHYRIS Dalman 1828

Delthyris 43635 sp. nov.

Genus AMBOCOELIA Hall 1860

Ambocoelia meristoides Meek var. 43106 var. nov.

Pseudopunctate Articulata

Superfamily Strophomenacea

Genus STROPHEODONTA Hall 1852

Stropheodonta 43724 sp. nov.

Stropheodonta 43225 sp. nov.

Stropheodonta 43234 sp. nov.

Stropheodonta 43629 sp. nov.

Stropheodonta 43311 sp. nov.

Punctate Articulata

Superfamily Dalmanellacea

Genus SCHIZOPHORIA King 1850

Schizophoria striatula Schlotheim var. 43247

var. nov.

Schizophoria 43248 sp. nov.

Schizophoria 43674 sp. nov.

Genus CYRTINA Davidson 1858

Cyrtina 43618 sp. nov.

Genus GYPIDULA Hall 1867

Gypidula 43298 sp. nov.

Plate: 3 Figures: 4-6

Very small form, equally biconvex, sub-pentagonal in outline. Greatest width at the mid-length. Lateral margins round gradually into the hinge line which is quite short and very straight. Four or five broad rounded plications. Line of commissure sharp and anteriorly denticulate where it swings in a ventral direction. Measurements of hypotype: length 7 mm.; width 7 mm.; thickness 5 mm..

Pedicle valve moderately convex, most strongly convex in the umbonal region; low broad fold extending from the umbonal region to the anterior extremity composed of two plications (two ridges and an included depression). Beak is prominent, incurved to the hinge line; large umbonal area. Interarea curved and poorly defined; delthyrium not observed in the specimen described. Shows indications of a medial septum being present.

Brachial valve slightly less convex than the pedicle valve especially towards the lateral margins. Broad shallow sulcus occupied by two plications (two depressions and a ridge). Beak is lower than the beak of the pedicle valve and is slightly incurved; umbonal area considerably smaller than that of the pedicle valve. Small, curved,

poorly defined interarea; notothyrium not visible.

The surface of both valves is smooth except for the plications which are best developed along and closely bordering the fold and sulcus.

Remarks: This species has not hitherto been described in literature discussing Mackenzie River Valley paleontology. This species closely resembles Gypidula munda Calvin as described by Stainbrook (1945) from the Independence shale of Iowa. This species differs in the nature of the beak which is more prominent, in the proportions (G. munda is wider than long) and in the nature of the plications which are stronger.

Locality: Mouth of Simple Creek, Bosworth Creek, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43298.

Geological horizon: "Upper Beavertail" limestone, Middle Devonian. This is not a type section Beavertail fossil.

Genus PENTAMERELLA Hall 1867

Pentamerella 43678 sp. nov.

Plate: 3 Figures: 1-3

Very small, biconvex, transversely sub-elliptical, wider than long, maximum width at the mid-length.

Lateral margins rounded into the very short hinge line. No fold or sulcus, line of commissure acutely denticulate anteriorly. Dimensions of two specimens: length 8 mm., 6.5 mm.; width 8 mm., 7.3 mm.; thickness 5 mm., 4 mm..

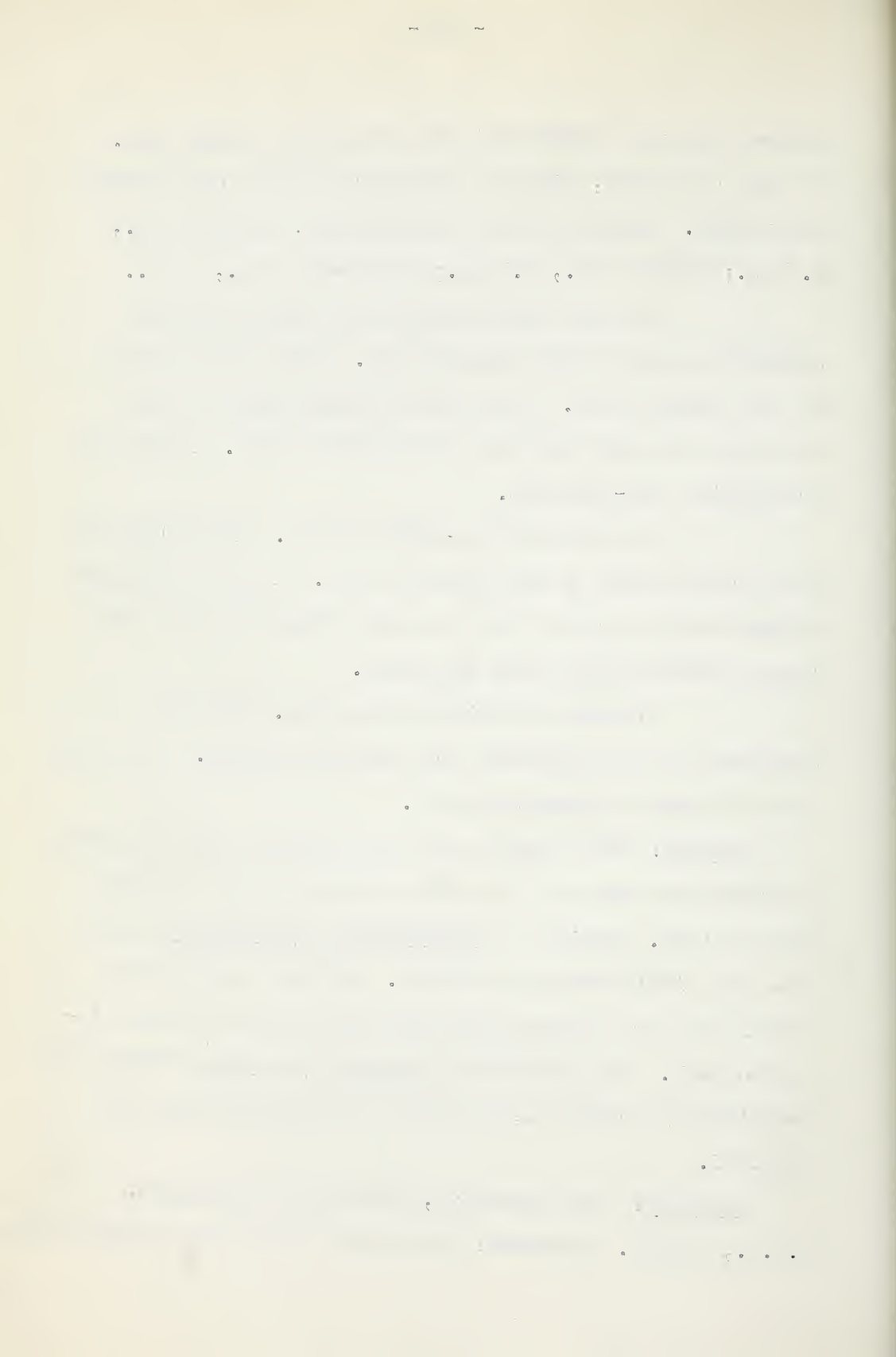
Pedicle valve moderately convex becoming strongly convex in the umbonal area. High medial ridge in the umbonal area. Small beak sharply incurved over the hinge line and beak of the brachial valve. Interarea practically non-existent.

Brachial valve weakly convex. Beak hidden by the incurved beak of the pedicle valve. A shallow poorly defined medial groove which is most evident near the mid length divides valve into two lobes.

Strong plications about 2 mm. long are developed near the lateral and anterior margins. No growth lines or other ornament present.

Remarks: This species has not hitherto been described in literature dealing with paleontology of the Mackenzie River Valley. Similar to Pentamerella obsolescens (Hall) from the Middle Devonian of Iowa. Differs in that the latter has more angular plications and a more strongly incurved beak. Also resembles Pentamerella arata (Conrad) as described by Branson (1923) from the Middle Devonian of Missouri.

Locality: West Mountain, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological



Collection - 43678.

Geological horizon: "Beavertail" limestone, Middle Devonian. This is not a Beavertail type section fossil.

Genus HYPOTHYRIDINA Buckman 1906

Hypothyridina 43214 sp. nov.

Plate: 1 Figures: 13-16

Medium sized shell, biconvex, raindrop shape in outline, moderately gibbous, terabratulid cardinal margin. Hinge line very short; position of greatest width slightly in front of the mid length of the shell. Line of commissure denticulate corresponding to the plications. Lateral margins round into the cardinal margins with no break in the outline. Wide, shallow sulcus on the pedicle valve forms a short lingulate extension in a dorsal direction. Sulcus carries 7 plications, lateral margins carry 13 plications. Measurements of hypotype: length 20 mm.; width 18.5 mm.; thickness 14 mm..

Pedicle valve moderately convex, beak not prominent but is strongly incurved over the hinge line and beak of the brachial valve. Sulcus, as described, is developed near the anterior margin and is not extended posteriorly. Interarea and delthyrium are not visible due to the incurved nature of the beak.

Brachial valve strongly convex; low broad fold developed near the anterior margin. Beak low and incurved under the incurved beak of the pedicle valve.

The specimen described is badly exfoliated and surface features could not be observed. The internal cast shows rounded plications (20 on each valve) and widely spaced growth lines (3 on each valve).

Remarks: This species has not previously been described in literature discussing the fossils of the Mackenzie River Valley. The lingualate extension of the sulcus is not as strongly developed as it is in other species of Hypothyridina which have been described. This species is similar to Hypothyridina cameroni Warren (1944) but its outline is distinctly different and the development of the sulcus is not as strong.

Locality: First waterfall on Bosworth Creek, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43214.

Geological horizon: "Upper Beavertail" limestone, Middle Devonian. This is not a Beavertail type section fossil.

Genus ATRYPA Dalman 1828

Atrypa arctica Warren var. 43232 var. nov.

Plate: 2 Figures: 1-4

Medium sized shell, circular in outline, greatest width at mid length, unequally biconvex. Hinge line equal to one-half the maximum width of the shell, slightly sinuous; cardinal angles rounded; front margin sinuous. Measurements of hypotype: length 29 mm.; width 29 mm.; thickness 15 mm..

Pedicle valve weakly convex, flattening towards the lateral margins, most strongly convex in the umbonal region. Wide shallow sulcus present near the anterior margin. The specimen is exfoliated so that most of the shell matter has disappeared but there is evidence that skirts were once present. In the region of the sulcus the margin swings from a ventral to a dorsal direction. The sulcus at the anterior margin is 17 mm. wide. Beak is prominent and upright extending 2 mm. above the hinge line; interarea triangular, inclined at an obtuse angle. Wide, triangular delthyrium (90°), nearly closed by deltidial plates. Round foramen at the posterior extremity.

Brachial valve strongly convex, well rounded. Tendency to flatten near the lateral margin. Narrow concave flare near the anterior margin opposite the sulcus of the

pedicle valve. No fold developed. Beak low and sharply incurved so that no interarea or notothyrium is visible.

Both valves carry regular non bifurcating costae spaced at 2 per mm. near the anterior margin. Indefinite widely spaced growth lines also noted on the internal mold. The specimen described was badly exfoliated so that none of the original shell surface was observed and only patches of shell matter could be examined.

Remarks: The diagnostic features of this species are the circular outline, high beak and the characteristic flare to the margins. It resembles Atrypa independensis Webster as described by Fenton and Fenton (1935) but the outline, beak and margin features of this species are divergent from that of the latter. This variety is very closely similar to Atrypa arctica Warren of the Elm Point limestone of Manitoba.

Locality: Forks of Bosworth and Schooner Creeks, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43232.

Geological horizon: "Upper Beavertail" limestone, Middle Devonian. This is not a Beavertail type section fossil. Its true position is lower in the Middle Devonian. It is probably characteristic of the Ambocoelia meristoides zone which includes beds correlative with the Pine Point limestone.

Atrypa arctica Warren var. 41085 var. nov.

Plate: 2 Figures: 5-7

Medium sized shell, biconvex, subovate in outline. Maximum width slightly behind the mid length; longer than wide. Lateral margins round abruptly into the hinge line which is equal to slightly more than one-half the maximum width of the shell and is sinuous. Front margin moderately sinuous; line of commissure sharp. Dimensions of the hypotype: length 32 mm.; width 30 mm.; thickness 18 mm..

Pedicle valve weakly convex; beak moderately developed but low, slightly incurved. Interarea small, curved and ill defined. Delthyrium not visible.

Brachial valve strongly convex and well rounded. Beak low and inconspicuous. No interarea or notothyrium visible.

Both valves carry fine radial striae spaced at 3 per 2 mm. Faint indications of concentric growth lines are present on the exfoliated surface of the internal mold.

Remarks: The species displays a characteristic outline. Resembles A. independensis Webster as described by Fenton and Fenton (1935). Differs in outline (A. independensis is

subquadrate) and does not show the growth lines of A. independensis. The striae on this hypotype are very fine.

This form shows a resemblance to Atrypa lineata Webster as described by Fenton and Fenton (1935) from the Upper Cedar Valley beds of Iowa. The latter, however, shows a more strongly developed sinus.

On the basis of the very fine striae, ~~and~~ the nature of the sinus and the outline this form is classed as a variety of Atrypa arctica Warren.

Locality: Walker Creek, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 41085.

Geological horizon: "Beavertail" limestone, Middle Devonian. This is not a Beavertail type section fossil.

Atrypa borealis Warren var. 42236 var. nov.

Plate: 3 Figures: 7-10

Medium sized, biconvex, circular outline. Position of greatest width slightly behind the mid length. Lateral margins round gradually into the hinge line which is about one-half maximum width of the shell. Front margin sinuate; line of commissure sharp. Dimensions of hypotype: length 20 mm.; width 21 mm.; thickness 9 mm..

Pedicle valve weakly convex, flattening in the posterior-lateral region. Weak development of a rounded sulcus from slightly in front of the mid-length to the front of the shell. Beak prominent and erect (about 1.5 mm. high). Interarea roughly triangular, moderate size. Triangular delthyrium (40°) partially closed by deltidial plates. Foramen in the posterior extremity.

Brachial valve moderately convex. Very low rounded fold near the anterior margin. Low insignificant beak, incurved. No interarea or notothyrium visible (not exposed).

Surface of both valves covered with coarse rounded radiating plications (24 on each valve) and weak concentric ornament (7 on each valve). Low nodes developed where the radial and concentric ornament intersect.

Remarks: This specimen is very similar to Atrypa borealis Warren var. lata except that this specimen is thinner, has a more rounded outline, the beak is higher and upright rather than incurved, the sulcus is more strongly developed and the surface decorations are *coarser* (28 radial plications on Atrypa borealis var. lata against 24 on this specimen).

Resembles Atrypa aspera prideri Coleman (1951) from the Middle Devonian of Western Australia, especially in the character of the upright beak.

Locality: The Ramparts, Mackenzie River, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 42236.

Geological horizon: "Beavertail" limestone, Middle Devonian. This is not a Beavertail limestone type section fossil.

Atrypa borealis Warren var. 43151 var. nov.

Plate: 4 Figures: 1-4

Small to medium sized, biconvex, subovate in outline. Length greater than width in the younger specimens and length less than width in the older specimens. Hinge line straight, equal to two-thirds of the maximum width. Maximum width behind the mid-length. Cardinal angles rounded. Front margin faintly sinuous. Shell is relatively thin especially in the younger specimens. Dimensions of three specimens: length 14 mm., 17 mm., 20 mm.; width 14 mm., 18 mm., 21 mm.; thickness 7 mm., 8 mm., 12 mm..

Pedicle valve moderately convex, most strongly convex along the medial region which is nearly ridge-like. No sulcus or fold developed. Small beak, incurved so that it overlaps over the beak of the brachial valve. Interarea not defined; delthyrium is not visible. Cardinal shoulders well developed but rounded.

Brachial valve moderately convex. No medial ridge developed as on the pedicle valve. No sulcus or fold. Small beak hidden by the incurved beak of the pedicle valve. Interarea not defined; notothyrium not visible.

Surface of both valves covered with strong rounded radiating costae. About 18 costae are developed on each valve. Approximately 10 strong, concentric lamellae are present on each valve. Where the lamellae and the costae intersect, nodes are developed on which spines may have developed but are not now present. No fine concentric ornament is present.

Remarks: This form is very similar to Atrypa spinosa Hall and may be a variety of same. It differs from forms of Atrypa spinosa from the Upper Devonian figured by Branson (1923) in that the costae of the latter are stronger and more widely spaced, the latter is relatively thicker and is broadly sinuate on the ventral valve unlike this hypotype.

This form is similar to Atrypa borealis var. lata Warren but the latter is more strongly biconvex (unequally biconvex), the concentric lamellae are not as strongly expressed, the radial costae are more numerous, and it has a broadly sinuate frontal margin.

Similar also to Atrypa "falconeri" from the Anderson River horizon of the Middle Devonian but is

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thinner and the front margin is less sinuate. Concentric ornament similar in both species. (Anderson River horizon is included in the Ambocoelia meristoides zone of the Middle Devonian in the Mackenzie River Valley.)

There is a remarkable similarity between this form and Atrypa aspera var. Kwangsiensis Grabau. The latter comes from Middle Devonian beds of China.

Locality: Bosworth Creek, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43151.

Geological horizon: "Upper Beavertail," Middle Devonian. This form has close affinities with fossils from the Ramparts formation and is not known to come from the Beavertail limestone type section.

Atrypa 43234 sp. nov.

Plate: 2 Figures: 8-11

Medium sized shell, unequally biconvex, outline subsemicircular to subquadrate, wider than long. Cardinal shoulders broken off but maximum width appears to coincide with the hinge line; cardinal angle sharp; hinge line sinuous. Dimensions of hypotype: length 26 mm.;

width 30 mm.(plus?); thickness 12 mm..

Pedicle valve weakly convex flattening in the posterior lateral area. Prominent upright beak extending 2 mm. above the hinge line. Interarea curved and poorly defined, marked by striae parallel to the hinge line. Wide triangular delthyrium (90°) about two-thirds closed by deltidial plates. Round foramen in the posterior extremity. No evidence of a fold or sulcus. Features of the hinge line not visible.

Brachial valve more strongly convex than the pedicle valve, tends to flatten in the posterior lateral area and to become more strongly convex towards the anterior margins. Beak low and strongly incurved so that the inter-area and notothyrium are not visible. No fold or sulcus.

The exterior surface of both valves (excepting the interareas) is covered with strong rib-like plications spaced at 8 per cm. near the anterior line of commissure, 40 such ribs being present on the brachial valve near the margins. Generation of new plications is by irregular bifurcation initiated at growth line interruptions. About four growth lines on each valve.

Remarks: This species has not hitherto been described in literature dealing with Mackenzie River Valley paleontology. Diagnostic features are the heavy ribs, the upright beak and the wide, partially closed delthyrium. It displays many

features of Atrypa desquamata Sowerby as figured by Grabau (1931) from the Middle Devonian of China and may be a variety of same.

Locality: Forks of Bosworth and Schooner Creeks, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43234.

Geological horizon: "Upper Beavertail" limestone, Middle Devonian. This is not a type section Beavertail fossil.

Atrypa 43625 sp. nov.

Plate: 2 Figures: 12-15

Medium sized, biconvex, subquadrate in outline, position of greatest width slightly in front of the hinge line; wider than long. Cardinal angles sharply rounded; hinge line slightly less than the maximum width, faintly sinuous. Front margin sharply sinuous, margins rounded. Dimensions of three specimens: length 26 mm., 23 mm., 22 mm.; width 31 mm., 27 mm., 26 mm.; thickness 13 mm., 13 mm., 11 mm..

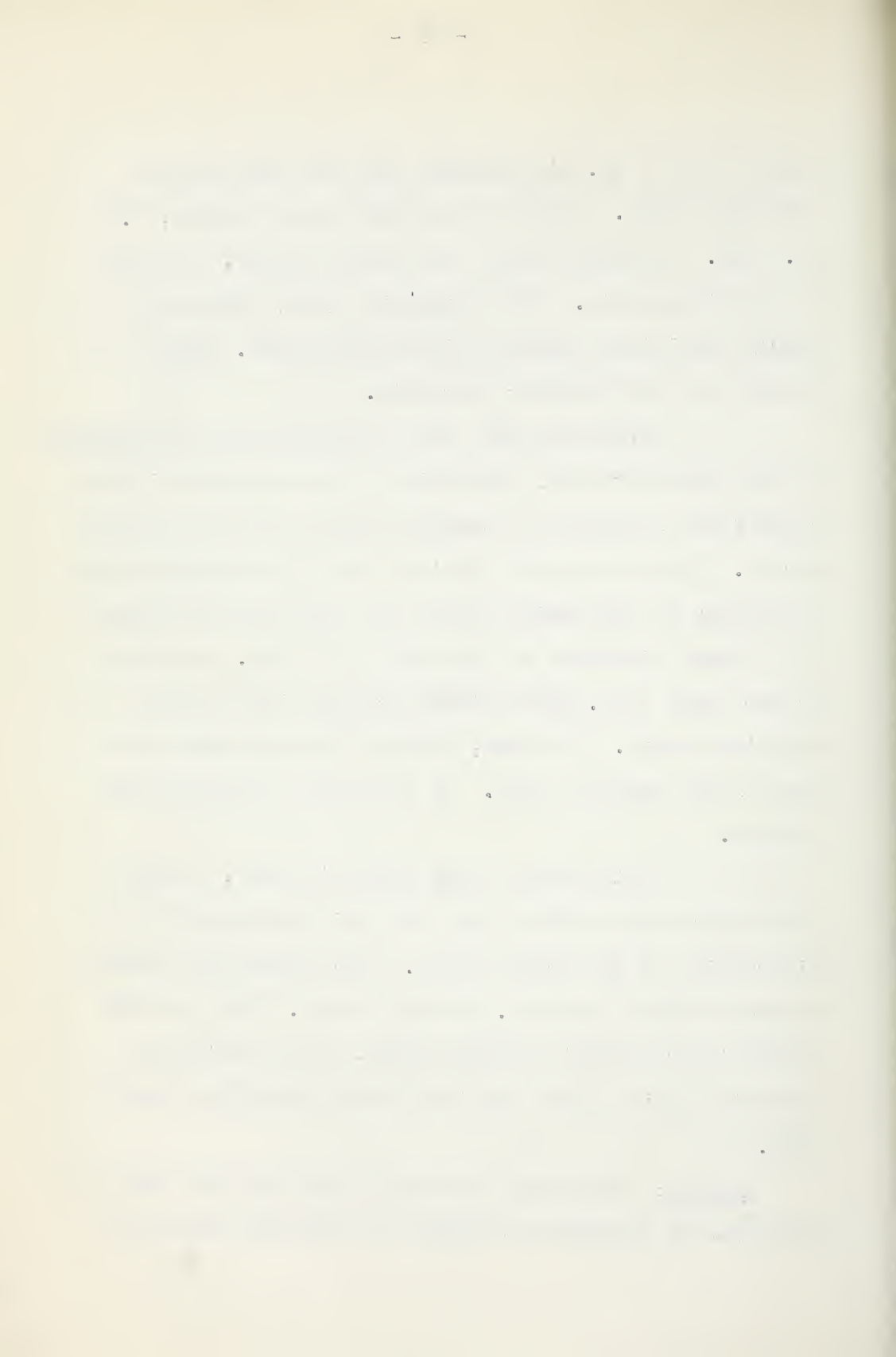
Pedicle valve weakly convex. Wide, deep sulcus developed from about mid-length to the anterior margin.

Narrow ridge 2 mm. wide extends from the beak to the anterior margin. Umbonal area small; beak upright, 1.5 mm. high. Interarea small and poorly defined, inclined at an obtuse angle. Wide triangular (90°) delthyrium nearly completely closed by deltidial plates. Small foramen in the posterior extremity.

Brachial valve more strongly convex (especially in the umbonal region) flattening in the posterior lateral regions and flaring in a concave manner near the anterior margin. There is no well defined fold to correspond with the sulcus of the pedicle valve but the margin is flared in a dorsal direction at the anterior margin. A narrow groove about 2 mm. wide extends from the beak to the anterior margin. Low beak, sharply incurved under the beak of the pedicle valve. No interarea or notothyrium visible.

Both valves carry about 24 heavy, rounded plications which radiate from the beak and multiply by bifurcation at the growth lines. Fine concentric striae spaced at about 8 per mm. on both valves. Four rounded growth lines present on both valves. Nodes developed where the growth lines and the radial plications intersect.

Remarks: Specimens similar to this have not been described in literature dealing with material from the



Mackenzie River Valley. This fossil can be easily recognized by its outline, heavy plications, coarse concentric ornament and fine concentric striae.

Locality: Morrow Mountain, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43625.

Geological horizon: "Marl above Beavertail," Middle Devonian. This is not a type section Beavertail fossil.

Genus DELTHYRIS Dalman 1828

Delthyris 43635 sp. nov.

Plate: 1 Figures: 17-20

Medium sized shell, biconvex, pedicle valve most strongly convex. Position of greatest width slightly in front of the hinge line; wider than long. Outline subsemicircular, lateral margins are rounded in a moderately abrupt manner into the hinge line. Hinge line straight, equal to slightly less than the maximum width of the shell. Line of commissure denticulate and frontal margin is sinuate in compensation for the sulcus and fold. Dimensions of hypotype: length 16 mm.; width 20 mm.; thickness 12 mm..

Pedicle valve moderately convex becoming more strongly convex in the umbonal region. Beak prominent and

slightly incurved over the interarea. Sulcus deep, rounded and broad extending from the umbonal region to the anterior margin and bounded by a plication on either side. Concentric ornament present in the sulcus as a continuation of ornamentation from the rest of the valve; no radial ornament. Interarea large and triangular and is curved in such a manner that the angle of inclination changes from right, near the hinge line to straight and reflex near the beak. Delthyrium large, triangular and open.

Brachial valve less convex than pedicle valve. Beak low and inconspicuous, incurved very slightly over the hinge line. Interarea very narrow and almost undefined. Broad, open notothyrium. Rounded prominent fold extending the full length of the valve, covered with fine concentric ornament which is continuous with the ornament from the rest of the shell.

Surface of both valves carries strong plications, 12 to each valve, strong, rib-like and rounded, extending from the umbonal region to the anterior and lateral margins. Exterior surface (excepting interareas) is covered with fine concentric lamellae (4 per mm.) and very minute radial lines (about 15 per mm.).

Remarks: Not previously described in literature dealing with fossils from the Mackenzie River Valley. Resembles Spirifer cyclopterus Hall as described by Branson (1923) in outline and decoration. Differs mainly in that the latter

is thinner and the interarea of the pedicle valve is smaller.

Locality: West Mountain, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43635.

Geological horizon: "Beavertail" limestone, Middle Devonian. This is not a Beavertail type section fossil.

Genus AMBOCOELIA Hall 1860

Ambocoelia meristoides Meek var. 43106

Plate: 1 Figures: 21-24

Shell small to medium sized, unequally bi-convex, ovate in outline. Lateral margins rounded gradually into the hinge line which is straight and equal in length to slightly more than one-half the maximum width of the shell. This form is slightly wider than long, position of maximum width being approximately at the mid-length. Line of commissure is sharp and frontal margin is straight. No fold or sulcus. Dimensions of the hypotype: length 15 mm.; width 16 mm.; thickness 10 mm..

Pedicle valve strongly convex; beak prominent, incurved moderately over the hinge line; interarea moderate in size, inclined at a straight to reflex angle and is well defined. Delthyrium triangular (30°) and open.

Brachial valve weakly convex; beak very small and insignificant, not incurved. Small triangular inter-area inclined at an obtuse angle.

Surface of valves (excepting interareas) is covered with concentric growth lines and very fine indistinct striae. The striae are spaced at approximately 9 per mm. and the growth lines are spaced at about 1 per 2 mm. in the central part of the ventral valve. The growth lines become more numerous and more closely spaced near the frontal margin.

Remarks: This form shows the following divergencies from Ambocoelia meristoides Meek as described by Meek in 1868; beak and interarea of the pedicle valve are larger and the interarea is better defined; outline is proportionately wider.

This form closely resembles a fossil collected from the "Beavertail" of Bosworth Creek. The latter shows less divergence from Ambocoelia meristoides Meek.

Location: Oscar Creek, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43106.

Geological horizon: "Top of Beavertail," Middle Devonian. This is not a Beavertail type section fossil. This fossil is more distinctive of a horizon lower in the Middle Devonian. Ambocoelia meristoides has been collected from the Hare Indian River shale and the Pine Point limestone. It is a zone fossil from the Middle Devonian (Ambocoelia meri-

stoides zone of Warren and Stelck, 1950).

Genus STROPHEODONTA Hall 1852

Stropheodonta 43724 sp. nov.

Plate: 4 Figure: 5
Plate: 3 Figures: 15-17

Medium sized shell, concavo-convex, sub-quadrate in outline. Maximum width at the hinge line, wider than long. Hinge line straight, cardinal angles sharp. Front margin is extended in a dorsal direction in a wide flare. Dimensions of 3 specimens: length 19 mm., 18 mm., 17 mm.; width 27 mm., 25 mm., 25 mm.; thickness (including concavity) 6 mm., 4.5 mm., 6 mm..

Pedicle valve weakly convex except towards the front of the shell where it becomes strongly convex and the aforementioned flare is developed. Beak very small and insignificant. Interarea extends full width of the shell, broadly triangular, 1 mm. wide in the beak area and diminishing to a point at the cardinal extremity. The interarea is inclined at an obtuse angle and carries about 40 denticles which are strongly expressed as ridges on the surface. Wide triangular delthyrium (45°) partially closed by a growth of shell material from the sides and posterior. No evidence of a fold or sulcus.

Brachial valve concave, closely follows the contours of the interior of the pedicle valve. Inter-area similar in morphology to the interarea of the pedicle valve, inclined at a right angle so that the two inter-areas form an obtuse angle between them. Wide triangular notothyrium nearly closed by a growth of shell material from the sides. A groove is present through the mid line of the notothyrium.

Surface of both valves excepting interareas covered with fine angular plications which multiply by intercalation anteriorly, spaced at 2 per mm. near the anterior margin. Specimen described carries 6 low overlapping growth lines. Both valves pseudopunctate.

Remarks: Similar material has not previously been described from the Mackenzie River Valley.

Locality: Frank Canyon, Imperial River, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43724.

Geological horizon: Basal Fort Creek, Upper Devonian.

Stropheodonta 43225 sp. nov.

Plate: 4 Figures: 6 and 10

Medium sized, concavo-convex, subsemi-circular in outline, position of greatest width at the

hinge line which is straight. Cardinal angles sharp. Very thin; front margin straight; line of commissure sharp. Dimensions of hypotype: length 18 mm.; width 26 mm.; thickness 4 mm..

Pedicle valve weakly convex, strongest convexity near the anterior and lateral margins, no sulcus or fold. Beak ill defined; interarea very broadly triangular (about 1 mm. wide at the delthyrium), inclined at an obtuse angle, carries about 44 denticles. Delthyrium triangular (30°) and open.

Brachial valve weakly concave following the contours of the interior of the pedicle valve. No sulcus or fold. Beak not developed. Interarea narrow (1 mm. wide at the notothyrium), extending to the cardinal angles. Interarea carries same number of denticles as the interarea of the pedicle valve. The interarea is inclined at an acute angle so that the two interareas together form an unbroken plane. Notothyrium triangular and open.

Both valves covered with fine angular plications which are spaced approximately at 2 per mm. (about 40 plications on each valve). Both valves pseudo-punctate. No growth lines or concentric ornament.

Remarks: This species has not hitherto been described from the Mackenzie River Valley. It closely resembles Stropheodonta 43234 sp. nov. and the two forms are possibly varieties of the same species.

Locality: Forks of Bosworth and Schooner Creeks,
District of Mackenzie, N.W.T., Canada. Hypotype:
University of Alberta Paleontological Collection - 43225.

Geological horizon: "Upper Beavertail" limestone,
Middle Devonian. This is not a Beavertail type section
fossil.

Stropheodonta 43234 sp. nov.

Plate: 4 Figures: 11-12

Medium sized shell, plano-convex, subsemi-circular in outline, greatest width at the hinge line which is straight. Cardinal angles sharp. No fold or sulcus; line of commissure sharp; frontal margin straight. A very thin form. Dimensions of hypotype: length 14 mm.; width 22 mm.; thickness 3 mm..

Pedicle valve weakly convex; beak undefined; interarea narrow, extending full length of the hinge line, inclined at an obtuse angle, carries about 40 denticles. Delthyrium open, triangular.

Brachial valve flat; beak undefined; narrow triangular interarea extending full length of the hinge line; interarea inclined at an acute angle so that the interareas of the two valves form a plane. Open notothyrium; denticles on the interarea (about 40).

Both valves covered with low angular plications, 30 to each valve. Both valves pseudopunctate. No growth lines or concentric ornament.

Remarks: Similar to Stropheodonta 43225 sp. nov. but is not concave in the brachial valve and has fewer plications (30 instead of 40). This form and Stropheodonta 43225 sp. nov. are possibly varieties of the same species. Has not hitherto been described in Mackenzie River Valley paleontological literature.

Locality: Forks of Bosworth and Schooner Creeks, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43234.

Geological horizon: "Upper Beavertail" limestone, Middle Devonian. This is not a Beavertail type section fossil.

Stropheodonta 43629 sp. nov.

Plate: 4 Figures: 7-9

Small concavo-convex shell, subquadrate in outline, position of maximum width at the mid-length. Hinge line straight, length nearly equal to the maximum width of the shell; cardinal angles sharp. Shell is very thin, wider than long. Front margin straight to faintly sinuous. Dimensions of four specimens: length 10 mm., 9 mm., 8.5 mm., 7.5 mm.; width 16 mm., 14 mm., 12 mm., 10.5 mm.; thickness 4 mm., 4 mm., 3 mm., 3 mm..

Pedicle valve convex, most strongly convex towards the front of the shell, wide low sulcus in the frontal area. Beak weakly developed, shows up as a very small projection over the posterior margin of the shell. Interarea narrow, extending full length of the hinge line; it is inclined at an obtuse to straight angle and shows approximately 30 denticles on the surface. Narrow, rectangular delthyrium nearly closed by a deltidium; foramen near the hinge line.

Brachial valve concave following quite closely the contours of the pedicle valve interior. Beak weakly developed; interarea narrow, extending the full length of the hinge line, inclined at an acute to right angle. Narrow rectangular notothyrium nearly closed by a chilidium. Interarea shows approximately 30 denticles on its surface.

Exterior surface of both valves (excepting interareas) carries radial plications, about 25 in number, each one well defined and angular. Plications increase in number anteriorly by intercalation rather than bifurcation. No concentric ornament or growth lines present.

Remarks: This species has not hitherto been described in literature dealing with Mackenzie River Valley paleontology. It has several characteristic features which serve to make it easy to recognize. Among these features are

its outline, size and the angular plications. All features of this fossil are fine and delicately constructed.

Resembles Stropheodonta solonensis Stainbrook of the Cedar Valley limestone of Iowa. Differs in outline and in the lack of fine radial striae.

Locality: Morrow Mountain, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43629.

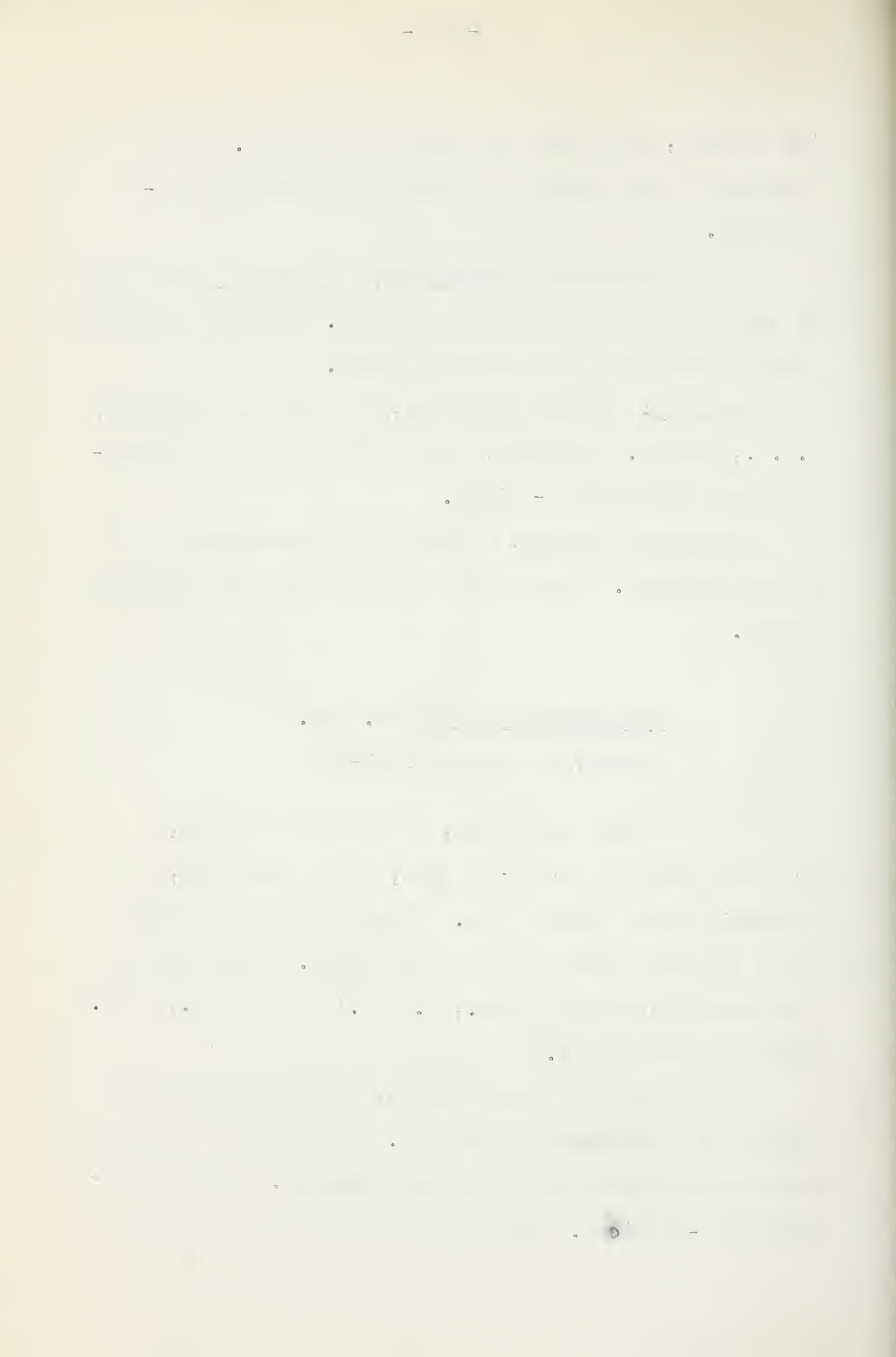
Geological horizon: "Marl above the Beavertail," Middle Devonian. This is not a Beavertail type section fossil.

Stropheodonta 43311 sp. nov.

Plate: 4 Figures: 13-14

Very small form, quadrate in outline, greatest width at the hinge line, wider than long, cardinal angles quite sharp. Hinge line straight and equal to the maximum width of the shell. Dimensions of two specimens: length 6 mm., 6.5 mm.; width 9 mm., 8 mm.; (pedicle valve only).

Pedicle valve convex, most strongly so in the lateral and anterior regions. Very faint indication of a wide sulcus near the anterior margin. Beak practically non-existent. Narrow interarea extending full



length of the hinge line, inclined at an obtuse angle. Denticles present (about 30) on the interarea. Features of the delthyrium not visible.

Both valves pseudopunctate. Radial plications spaced at about 3 per mm., low but angular, widely spaced in relation to their width. No concentric ornament.

Remarks: This species has not hitherto been described in literature dealing with Mackenzie River Valley paleontology. Similar to Stropheodonta 43629 sp. nov. but is less transverse, pedicle valve is more strongly convex and the plications are not as well expressed. Not as delicately constructed as Stropheodonta 43629 sp. nov..

Locality: Bosworth Creek, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43311.

Geological horizon: "Upper Beavertail" limestone, Middle Devonian. This is not a Beavertail type section fossil.

Genus SCHIZOPHORIA King 1850

Schizophoria striatula (Schlotheim) var. 43247 var. nov.

Plate: 1 Figures: 9-12

Small to medium sized, biconvex, subquadrate in outline, position of greatest width at the mid-length,

wider than long, lateral margins rounded fairly abruptly into the hinge line which is straight and equal to three-quarters of the maximum width. Front margin sinuous.

Both valves are of the same length. Dimensions of four specimens are: length 14 mm., 13 mm., 11 mm., 9 mm.; width 19 mm., 18 mm., 14 mm., 12 mm.; thickness 9 mm., 8 mm., 8 mm., 5.5 mm..

Pedicle valve weakly convex; low rounded sulcus developed near the anterior margin; umbonal area well expressed and the beak is prominent though small. Moderately large well defined triangular interarea; inclined at an obtuse angle. Triangular delthyrium (20°); open.

Brachial valve more strongly convex than the pedicle valve. No fold developed to correspond with the sulcus of the pedicle valve. Beak prominent though small. Interarea narrow and triangular, very sharply defined, inclined at a straight to obtuse angle. Low broad notothyrium; open.

Both valves covered with fine radial costae spaced at 5 per mm. near the anterior margin. Multiply laterally by irregular bifurcation. No growth lines or concentric ornament.

Remarks: This species has not hitherto been described in literature dealing with paleontology of the Mackenzie

River Valley.

Schizophoria 43247 sp. nov. is closely allied to Schizophoria striatula (Schlotheim). It differs from specimens of the latter figured from Missouri by Branson (1923) in that the width is proportionately greater, it is thinner and is a smaller form. There are remarkable similarities in striae, growth lines and general appearance. The Missouri form is Upper Devonian in age (Portage - Genesee). S. 43247 also resembles Schizophoria nevadaensis (Merriam). Differs in that the latter is thicker and is a larger form. The latter form is from a horizon near the base of the Middle Devonian.

Schizophoria 43247 rather closely resembles Schizophoria striatula mut. alpha Grabau from the Middle Devonian beds of China. Differs mainly in that the latter is less transverse, the interarea of the brachial valve is smaller and the hinge line is relatively shorter.

Locality: Bosworth Creek, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43247.

Geological horizon: "^{Upper}~~Maclure~~ above Beavertail," Middle Devonian. This is not a Beavertail type section fossil.

Schizophoria 43248 sp. nov.

Plate: 1 Figures: 1-4

Medium sized shell, unequally biconvex, subquadrate in outline, gibbous. Straight hinge line, about two-thirds maximum width of the shell. Lateral margin rounds rather abruptly into the hinge line; position of greatest width at mid-length of the shell. Margins rounded; line of commissure sharp and finely denticulate, swings in a dorsal direction in the frontal region. Dimensions of hypotype: length 18 mm.; width 21 mm.; thickness 15 mm..

Pedicle valve less convex than the brachial valve (brachial valve is about twice as thick), both valves are equal in length. Beak small and pointed. Gently curved interarea inclined at an obtuse angle, moderately large, triangular. Triangular (20°) open delthyrium. Sulcus wide and rounded extending from the anterior margin to about two-thirds of the way down the s hell.

Brachial valve more strongly convex than the pedicle valve. Beak not prominent, incurved over the hinge line. Narrow triangular interarea inclined at a straight to reflex angle, open notothyrium. A very low rounded fold is present extending from the anterior margin to about one-third of the way down the shell.

Exterior of both valves covered with fine costae spaced at 4 per mm. near the anterior margin. New costae originate by intercalation rather than bifurcation. Strong growth lines in the form of overlapping ridges are well developed especially towards the lateral and anterior margins giving the shell a wrinkled appearance. Where the outer layer of shell is exfoliated the under layer shows a pitted appearance indicating punctae. The punctae do not show any pattern but are quite irregular in their arrangement and are very fine and closely spaced.

Remarks: This appears to be a species of Schizophoria but unlike any other species of Schizophoria described from the Mackenzie River Valley to date.

Locality: Below first waterfall, Bosworth Creek, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43248.

Geological horizon: "Upper Beavertail" limestone, Middle Devonian. This is not a Beavertail type section fossil.

Schizophoria 43674 sp. nov.

Plate: 1 Figures: 5-8

Medium sized, biconvex, transversely elliptical, greatest width at the mid-length, wider than long. Lateral margins curve gradually into the hinge line which is straight and equal to three-fifths of the

maximum width of the shell. Line of commissure sharp, frontal margin straight. Dimensions of hypotype: length 19 mm.; width 25 mm.; thickness 11 mm.. Both valves are equal in length.

Pedicle valve weakly convex, no fold or sulcus developed. Beak narrow but conspicuous; inter-area large and triangular, inclined at an obtuse angle. Triangular delthyrium (30°), open.

Brachial valve more strongly convex than the pedicle valve; beak inconspicuous; interarea narrow and triangular, sharply defined, inclined at a straight angle; notothyrium open.

Surface of both valves covered with fine radiating costae spaced at 4 per mm. which multiply laterally by irregular bifurcation. No growth lines or concentric ornament.

Remarks: This species has not hitherto been described in the literature discussing paleontology of the Mackenzie River Valley. Its outline and fine costae are characteristic features.

Locality: West Mountain, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43674.

Geological horizon: "Beavertail" limestone, Middle Devonian. This is not a Beavertail type section fossil.

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Genus CYRTINA Davidson 1858

Cyrtina 43618 sp. nov.

Plate: 3 Figures: 11-14

Small to medium sized, biconvex, marked by extreme development of the interarea of the pedicle valve giving the shell a pyramidal appearance. Greatest width at the hinge line. Cardinal angles acute; hinge line straight; front margin sinuate. Dimensions of hypotype: length 10.5 mm.; width 18 mm.; thickness 15 mm..

Pedicle valve moderately convex; beak pointed; interarea large and triangular (11.5 mm. long and 18 mm. wide), marked by transverse striae and undulations, slightly twisted. Delthyrium about half closed by a deltidial plate, open in the posterior half. Low, rounded, poorly defined sinus.

Brachial valve weakly convex; low rounded poorly defined fold; beak low and inconspicuous; no interarea exposed.

Surface of both valves covered with 14 rounded plications. No concentric ornament or growth lines.

Remarks: Similar to Cyrtina panda Meek but this specimen carries no concentric ornament and is larger than the type specimens. The sinus and fold of Cyrtina panda are well defined and carry concentric ornament

which is unlike this species. The cardinal angles are acute rather than obtuse or at right angles as in Cyrtina panda Meek. Has fewer costae than Cyrtina billingsi Meek. Does not have the angular sulcus and fold of Cyrtina hamiltonensis Hall.

Locality: Morrow Mountain, District of Mackenzie, N.W.T., Canada. Hypotype: University of Alberta Paleontological Collection - 43618.

Geological horizon: "Marl above the Beavertail," Middle Devonian. This Cyrtina is not a Beavertail type section fossil but shows some affinities to Cyrtina panda Meek, the zone fossil for the Beavertail limestone.

CHAPTER 4

SUMMARY OF CONCLUSIONS

None of the "Beavertail" fossil collections of the Canol project examined in the course of this study are correlative with the type section Beavertail formation.

Certain factors must be considered in drawing these conclusions. One difficulty is that the writer did not personally visit Canol fossil collecting localities and make additional observations. Unknown factors are relative abundance of fossil species, exact position of collecting horizons in critical sections, footage range of fossiliferous sections grouped under one suite number and the detailed lithology of the rocks from which the fossils were taken. Another difficulty is the determination of primary errors made in collecting and labelling the fossils.

In the fossil collections studied there appeared to be very little correlation between the fossils of the type section of the Beavertail formation and the fossils labelled as Beavertail from other areas. The fossils of the Beavertail type section (on Carcajou Ridge) were placed in the Cyrtina panda zone of uppermost Middle Devonian age by Warren and Stelck (1950). The fossil

content of this zone is outlined on page 23 of this report. Coenites sp. is the only element of the Crytina panda zone which appears in the collections from other areas which were examined in the course of this study. Coenites sp. however is known to be long ranging and is not a diagnostic fossil for any particular zone. Martinia franklinii Meek appears in the collections studied and it is closely related morphologically to Martinia occidentalis Merriam which is a member of the Cyrtina panda zone assemblage. However Martinia occidentalis Merriam is not present in the collections studied.

It appears however that the various sections of "Beavertail" limestone from which the Canol fossils were collected are correlative with one another, approximately at least, on the basis of their fossil content. The writer believes that the fossil assemblages that were studied belong in the Ambocoelia meristoides zone of the Middle Devonian. This indicates that the "Beavertail" formation as recognized by the Canol geologists is actually a limestone or marl horizon much lower in the Middle Devonian than the Cyrtina panda zone. It is possible that post Middle Devonian pre Upper Devonian erosion removed the true Beavertail limestone from these sections or the eroded Middle Devonian paleotopographic hills provided areas of non-deposition.

A discrepancy was noted in that Hume (1922) mentioned a fossil assemblage from the Beavertail limestone of Carcajou Ridge (northern end) that includes several elements of the Ambocoelia meristoides zone which are recognized in the "Beavertail" limestone of Bosworth Creek. This zone was underlain by beds bearing Stringocephalus burtini. It is possible that these beds on Carcajou Ridge are actually in the Stringocephalus burtini zone which carries some elements of the Ambocoelia meristoides zone.

Some of the fossils studied showed close affinities with Middle Devonian forms of China, Australia, and the United States. An attempt was made to make age determinations of the Mackenzie River material on the basis of fossil assemblages from the Devonian of the United States but no conclusions were reached.

The various species of the genus Atrypa present in the collections studied show considerable variation in their features. Much more collecting is necessary in order to understand the stratigraphic significance of the various forms of species related to Atrypa reticularis, Atrypa borealis and Atrypa arctica.

The faunal assemblage from the "marl above the Beavertail" of Morrow Mountain appears to belong in the same zone as the "Beavertail" faunas from other areas.

Several species and varieties are described which are considered to be new. It is possible that after more fossil collecting has been done in the Lower Mackenzie River Valley it will be found that they constitute members of a new zone or subzone in the Middle Devonian.

Plates 1 - 6

Illustrations of brachiopoda from the Devonian of the Mackenzie River Valley. Plates 5 and 6 illustrate fossils from the Beavertail limestone type section.

All locations given are locations in the Mackenzie River Valley, District of Mackenzie, N.W.T., (note map, Figure 2).

Illustrations are natural size unless otherwise stated.

PLATE - 1



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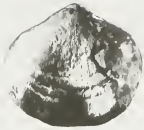
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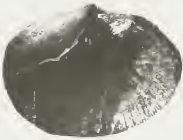
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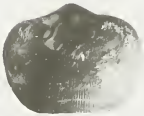
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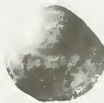
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Explanation of Plate 1

Figures 1, 2, 3, 4: Schizophoria 43248 sp. nov.,
hypotype, from Middle Devonian, Bosworth
Creek; 1, ventral view; 2, posterior view;
3, anterior view; 4, side view.

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Figures 5, 6, 7, 8: Schizophoria 43674 sp. nov.,
hypotype, from Middle Devonian, West Moun-
tain; 5, ventral view; 6, side view; 7,
posterior view; 8, dorsal view.

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Figures 9, 10, 11, 12: Schizophoria striatula var.
43247 var. nov., hypotype, from Middle
Devonian, Bosworth Creek; 9, dorsal view;
10, posterior view; 11, anterior view; 12,
ventral view.

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Figures 13, 14, 15, 16: Hypothyridina 43214 sp. nov.,
hypotype, from Middle Devonian, Bosworth
Creek; 13, ventral view; 14, side view;
15, posterior view; 16, anterior view.

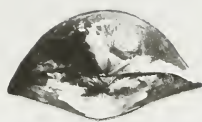
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Figures 17, 18, 19, 20: Delthyris 43635 sp. nov.,
hypotype, from Middle Devonian, West Moun-
tain; 17, dorsal view; 18, posterior view;
19, side view; 20, anterior view.

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Figures 21, 22, 23, 24: Ambocoelia meristoides var.
43106 var. nov., hypotype, from Middle
Devonian, Oscar Creek; 21, dorsal view;
22, ventral view; 23, side view; 24, post-
erior view.

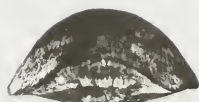
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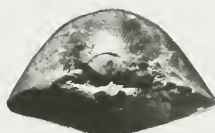
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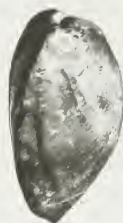
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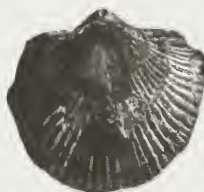
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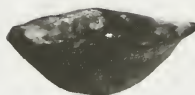
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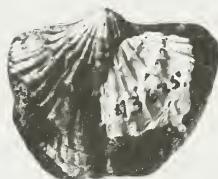
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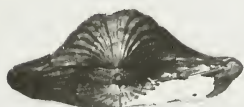
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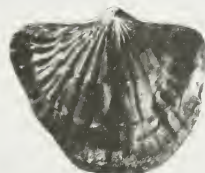
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Explanation of Plate 2

Figures 1, 2, 3, 4: Atrypa arctica var. 43232 var. nov.,
hypotype, from Middle Devonian, Bosworth
Creek; 1, posterior view; 2, ventral view;
3, anterior view; 4, side view.

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Figures 5, 6, 7: Atrypa arctica var. 41085 var. nov.,
hypotype, from Middle Devonian, Walker Creek;
5, posterior view; 6, side view; 7, ventral
view.

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Figures 8, 9, 10, 11: Atrypa 43234 sp. nov., hypotype,
from Middle Devonian, Bosworth Creek; 8, dorsal
view; 9, posterior view; 10, side view; 11,
anterior view.

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Figures 12, 13, 14, 15: Atrypa 43625 sp. nov., hypotype,
from Middle Devonian, Morrow Mountain; 12,
ventral view; 13, posterior view; 14, dorsal
view; 15, side view.

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PLATE - 3



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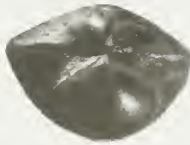
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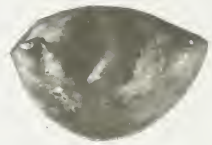
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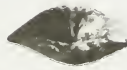
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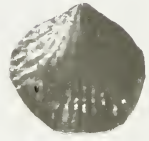
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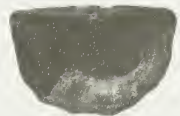
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Explanation of Plate 3

Figures 1, 2, 3: Pentamerella 43678 sp. nov., hypotype, from Middle Devonian, West Mountain; 1, dorsal view; 2, posterior view; 3, side view. (1, 2, 3 - x 4).

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Figures 4, 5, 6: Gynidula 43298 sp. nov., hypotype, from Middle Devonian, Bosworth Creek; 4, dorsal view; 5, posterior view; 6, anterior view. (4, 5, 6 - x 4).

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Figures 7, 8, 9, 10: Atrypa borealis var. 42236 var. nov., hypotype, from Middle Devonian, Ramparts of the Mackenzie River; 7, dorsal view; 8, posterior view; 9, side view; 10, ventral view.

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Figures 11, 12, 13, 14: Cyrtina 43618 sp. nov., hypotype, from Middle Devonian, Morrow Mountain; 11, posterior view; 12, anterior view; 13, dorsal view; 14, side view.

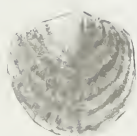
Page 69

Figures 15, 16, 17: Stropheodonta 43724 sp. nov., hypotype, from Devonian, Imperial River; 15, ventral view; 16, posterior view; 17, dorsal view.

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PLATE - 4





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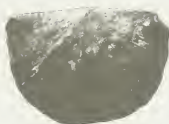
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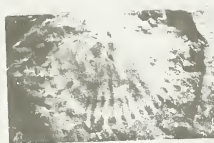
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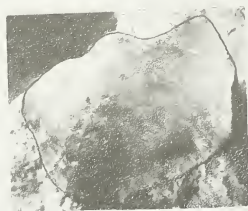
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Explanation of Plate 4

Figures 1, 2, 3, 4: Atrypa borealis var. 43151 var. nov.,
hypotype, from Middle Devonian, Bosworth
Creek; 1, ventral view; 2, anterior view;
3, posterior view; 4, side view.

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Figure 5: Stropheodonta 43724 sp. nov., hypotype, from
Devonian, Imperial River; view of interareas
and openings of both valves, pedicle valve
uppermost. (x 5).

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Figures 6, 10: Stropheodonta 43225 sp. nov., hypotype,
from Middle Devonian, Bosworth Creek; 10, ven-
tral view; 6, view of interareas and openings
of both valves, pedicle valve uppermost. (x 5).

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Figures 7, 8, 9: Stropheodonta 43629 sp. nov., hypotype,
from Middle Devonian, Morrow Mountain; 7,
dorsal view; 8, view of interareas and openings
of both valves, pedicle valve uppermost (x 5);
9, ventral view.

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Figures 11, 12: Stropheodonta 43234 sp. nov., 12, hypotype,
from Middle Devonian, Bosworth Creek; 11, ex-
foliated ventral valve; 12, dorsal valve.

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Figures 13, 14: Stropheodonta 43311 sp. nov., 14, hypotype,
from Middle Devonian, Bosworth Creek; 13,
ventral view; 14, ventral view. (13, 14 - x 4).

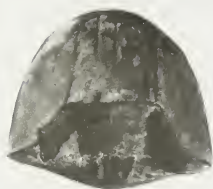
Page 62



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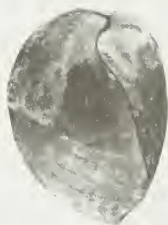
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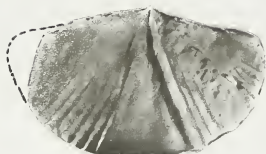
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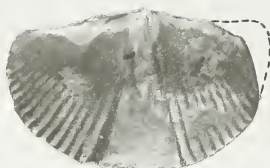
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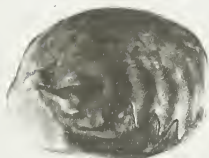
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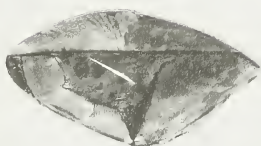
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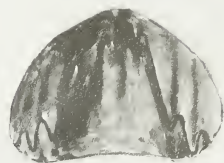
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Explanation of Plate 5

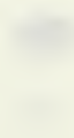
Figures 1, 2: Martinia cf. occidentalis Merriam, from Beavertail limestone type section, Carcajou Ridge; 1, ventral view; 2, side view.

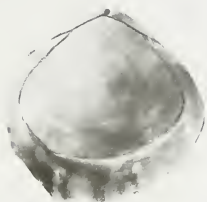
Figures 3, 4, 5: Leiorhynchus cf. castanea Meek, from Beavertail limestone type section, Carcajou Ridge; 3, anterior view; 4, ventral view; 5, side view.

Figures 6, 7, 9: Spirifer euryteines Owen, from Beavertail limestone type section, Carcajou Ridge; 6, ventral view; 7, dorsal view; 9, posterior view.

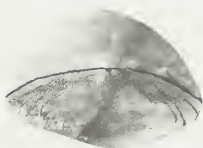
Figures 8, 10: Pugnoides sandersoni Warren, from Beavertail limestone type section, Carcajou Ridge; 8, side view; 10, anterior view.

PLATE - 6





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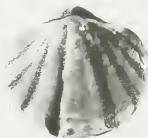
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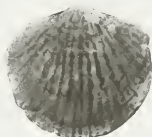
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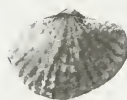
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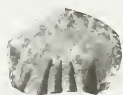
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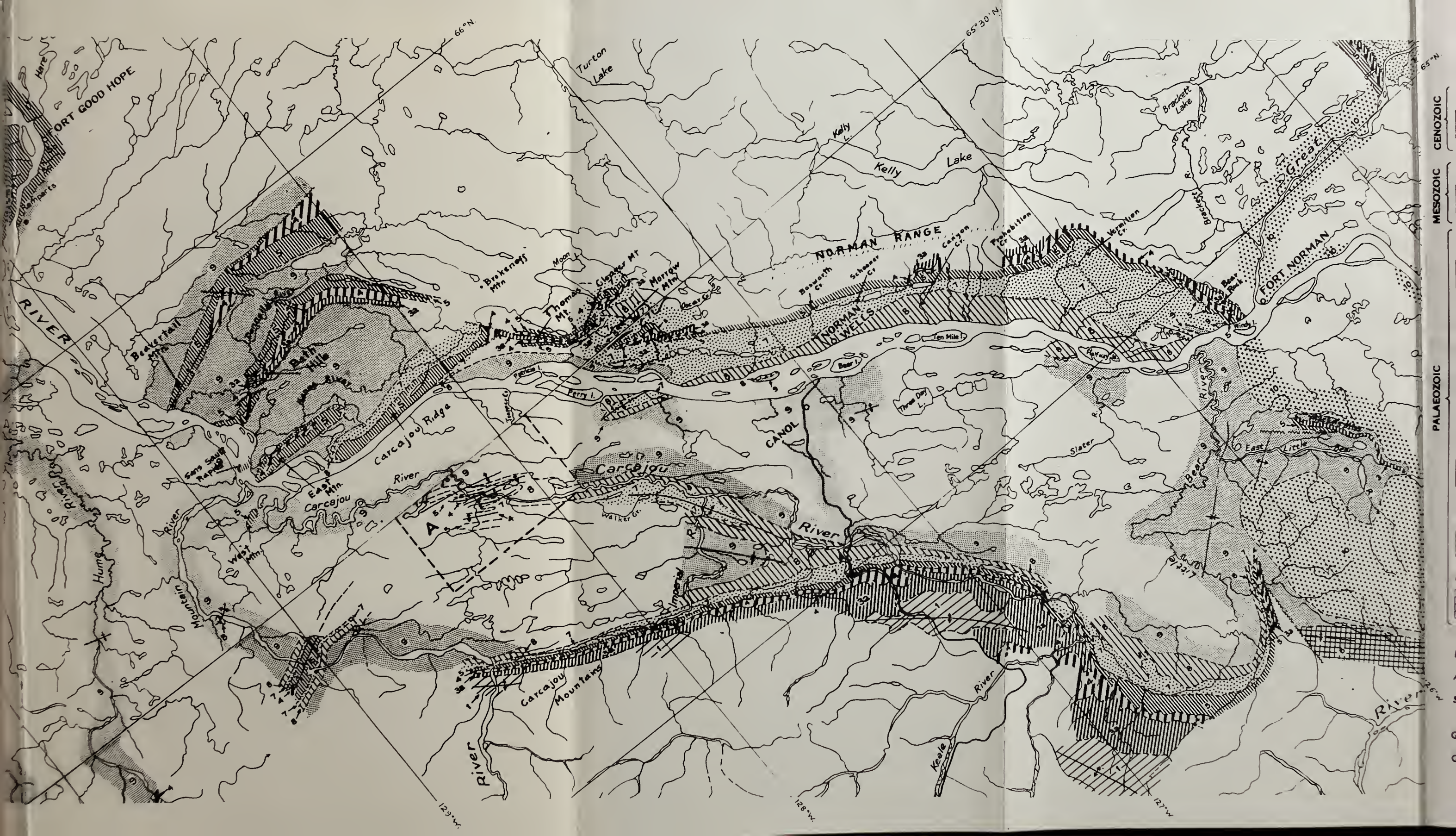
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Explanation of Plate 6

- Figures 1, 2, 3: Pugnax sp. nov., from Beavertail limestone type section, Carcajou Ridge; 1, dorsal view; 2, posterior view; 3, ventral view. (1, 2, 3 - x 4).
- Figures 4, 5, 6, 7: Spirifer sp. nov., from Beavertail limestone type section, Carcajou Ridge; 4, ventral view; 5, anterior view; 6, dorsal view; 7, side view. (4, 5, 6, 7 - x 4).
- Figures 8, 9, 10, 11: Atrypa sp. nov., from Beavertail limestone type section, Carcajou Ridge; 8, ventral view; 9, posterior view; 10, dorsal view; 11, side view.
- Figures 12, 13, 14: Pugnoides solon T. and S., from Beavertail limestone type section, Carcajou Ridge; 12, ventral view; 13, anterior view; 14, posterior view.
- Figures 15, 17: Cyrtina panda Meek, from Beavertail limestone type section, Carcajou Ridge; 15, side view; 17, anterior view.
- Figure 16: Tylothyris cf. inutilis (Hall), from Beavertail limestone type section, Carcajou Ridge; ventral view.
- Figures 18, 19, 20, 21: Athyris vittata var. buffaloensis Stainbrook, from Beavertail limestone type section, Carcajou Ridge; 18, posterior view; 19, anterior view; 20, side view; 21, dorsal view.



MESOZOIC

PALAEZOIC



LEGEND

CENOZOIC	TERTIARY		Conglomerate, sandstone, shale, coal; non-marine
		10	
MESOZOIC	CRETACEOUS		Sandstone, shale, coal; marine and non-marine
		9	
PALAEOZOIC	DEVONIAN		
	UPPER DEVONIAN		
		8	IMPERIAL FORMATION: sandstone, shale; marine
		7	FORT CREEK FORMATION: dark bituminous shales with coral reef and other limestone members; marine
		6	DEVONIAN Undivided
	MIDDLE DEVONIAN		
		5	RAMPARTS FORMATION: limestone, calcareous shale; marine
	SILURIAN OR DEVONIAN		
		4	BEAR ROCK FORMATION: dolomite, gypsum and anhydrite
	SILURIAN		
		3	RONNING GROUP 3a, limestones with chert; marine
	CAMBRIAN		
		1	Green and red shales with gypsum, limestone, sandstone, quartzite

Fault	~~~~~
Anticlinal axis	———↑———
Synclinal axis	———↓———

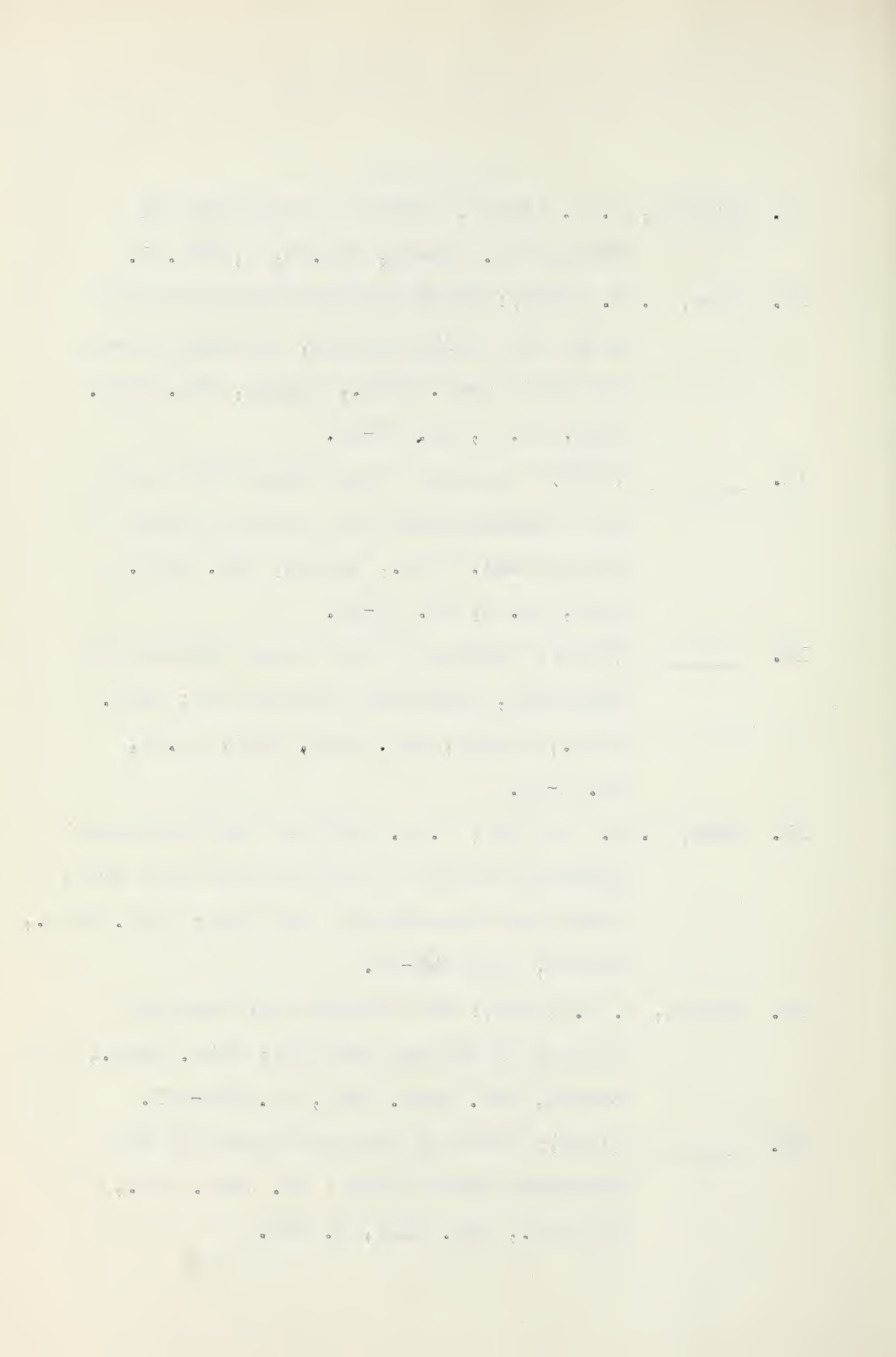
Geology by Canol geologists under the supervision of T. A. Link

Geological compilation by G. S. Hume

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